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Starch Products in the Paper and Textile Industries

Value and Importance—Mechanism Involved—Recent Studies—Physical States of Starch—Starch in Paper Making—Plastic Starch Pastes as Bonding Agent—Starch Solutions—Tape Sizing of Yarns —Size Penetration

By ROBERT P. WALTON

PAPER and textile mill operators have long recognized the application of starch pastes, flours, dextrins and gums as a procedure of prime importance. The total quantity of such products used in the United States amounts to something over 250,000,000 pounds annually* The quantity or value of the products themselves represents only a small fraction of the real importance attached to the processes of their application, for the value of the resulting products is affected markedly by the degree of success of these operations. Coating, filling, backing, sizing, finishing, color thickening, desizing, etc., are the processes specifically under consideration. The character of the finished paper or textile products, that is, the "feel," "handle," appearance, etc., is dependent to a large extent upon the nature of these sizing or coating treatments.

Mechanism Involved and Procedure Empirical

Despite the ostensible importance of these processes and their recognized intrinsic value to the mill operator, a general fundamental knowledge as to principles involved has been lacking. The mechanism of these processes has been rather obscure, and the methods of procedure have been highly empirical. The fault does not rest entirely with the industries. In both paper and textile manufacture there has been a considerable amount of intensive research in other directions. Pulp chemistry, bleaching processes, dyehouse control, etc., have profited greatly by the results of fundamental research. The recent standardization of color fastnesses by the American Association of Textile Chemists and Colorists is a commendable example of co-operation research. The same researchers and technologists associated with these and other developments would have applied their technique of experimental investigation to sizing and coating processes if profitable results had been readily forthcoming. These processes, however, have not reacted very encouragingly to the experimenter attempting to improve on traditional practices. The high molecular weight of starch, its colloidal character, the mechanics of rupturing the granule and the complicated array of products obtained by subjecting starches to various treatments have all served to discourage any procedure other than rule-of-thumb, empirical methods.

Recent Studies

Certain aspects of the problem have recently been attacked in a very fundamental way by the British Cotton Industry Research Association at the Shirley Institute, Didsbury, Manchester. A number of experimenters have been engaged in determining the elasticity and tensile strength of starch; the effect on sizing of such mechanical conditions as roller pressure, speed of sizing and concentration of size; growth of mould fungi on flours, starches and dextrins; and other basically important problems.

The more definite conclusions resulting from this work have recently been presented by F. D. Farrow, a research member of the B. C. I. R. A., in a symposium of papers on starch chemistry, edited by the writer and published last month.† In the same Symposium volume, W. A. Nivling has presented the results of his experience in the use of variously modified starches for the treatment of paper and textiles. The use of various diastatic enzymes for desizing textiles has also been detailed by H. C. Gore, H. G. Turley, Leo Wallerstein and Jokichi Takamine, Jr. The work of each of these men in one way or another has contributed toward a theoretical clarification of the above processes or toward the more effective execu-

*U. S. Foreign and Domestic Commerce Bureau: Commerce Reports No. 49, page 612 (1926).

†"A Comprehensive Survey of Starch Chemistry," 1928. Chem. Cat. Co., New York City.

tion of such processes. Continuation of this type of work unquestionably must result in marked developments in the treatment of paper and textiles. Some of the more salient features of these articles are given here.

Physical States of Starch

Nivling states that paper and textile uses of starch require its application in the natural unswollen state, in the slightly swollen state, in the well gelatinized state, and in more or less complete colloidal solution.

Suspended Starch Used in Paper Making

As an example of the first type, the use of natural starch in paper making is cited, the starch granules being simply suspended in water and distributed throughout the paper pulp by the mechanical agitation of the "Beaters," the "Chests" and the "Jordans." The starch granules swell and a portion are bursted open when the sheet of paper is dried by passing over steam-heated rollers. Although starch is thus used to some extent, the more general practice is that of first suspending the starch in water and heating until the granules are swollen. In this way considerable loss on the machine is avoided.

Plastic Starch Pastes Used as Bonding Agent

Starch in a gelatinized but undissolved state, i. e., a starch paste, is used as a bonding agent in paper and textile manufacture and associated industries. Several plys are bonded together, as, for example, in the manufacture of wedding stationery, greeting cards, bristols for placards, duplex reinforced cloth and paper wrappers, laminated paper for shipping containers, etc., starch being used as the bonding adhesive. "The starch granules are more or less completely swollen and ruptured, but the granules are not brought into complete solution; in fact, with practically all uses of starch as a paste, precautions are purposely taken to limit the amount that goes into solution, the object being to preserve a gelatinous mass that will limit penetration, so that the starch will remain on the surface where it will most effectively serve as an adhesive.

"Starch pastes in which the granules are gelatinized but not dissolved are used at various concentrations, ranging from a free flowing consistency to that of a putty-like consistency. These pastes are, then, mixtures of granules of varying degrees of gelatinization, blended together with portions of the starch which have been brought into solution. They are not as smoothly free flowing as an oil, regardless of the softness of the paste. Even in the soft paste consistencies, flow is interfered with by the large percentage of undissolved material. Such mixtures or suspensions, where the ratio of undissolved particles is sufficiently high as to bring about a structure from contact of undissolved particles, are designated as *plastics*. Free flow is prevented by the interference of undissolved particles and by *structural formation*. Flow is had only when pressure is applied. A sufficient flow to penetrate at least superficially is essential, so that an anchorage may be established. Where pastes are used in such high concentration as to bring about a putty-like consistency, the necessary flow is brought about by power applied through spreading rolls or transfer rolls which distribute the paste so that a uniform, thin film is applied. The several sheets are brought together simultaneous with or very promptly after the paste is applied, and more or less pressure is applied to bring about close contact between the two sheets of paper. When used in a very stiff consistency the dough-like mass of paste may be placed between the plys of paper, and the spreading and bonding is brought about by passing the paper and paste through the nip of a pair of squeeze rolls. In other uses of starch paste the consistency may be so soft as to admits of its being applied by a brush."

Starch Solutions

In describing the so-called starch solutions Nivling emphasizes the fact that natural starch granules are made up of two principal substances, one of which is soluble, the other relatively insoluble. "This was first observed by De Saussure in 1819 and numerous investigators since have employed various names to designate these two principal constituents. As examples there may be cited granulous and cellulose, farinose and amyloerythrin, Alpha and Peta amylose, amylopectin and amylose. The outer shell of the starch granule is composed of a substance quite insoluble in cold water which, when heated to temperatures above 140° F., merely swells to a gelatinous state. This less soluble material is generally known as 'amylopectin.' The inner substance of the starch granule, which is quite soluble even in cold water, has been termed 'amylose.' The ratio of these two substances varies in starches of different origin, the amylopectin being very much higher in the cereal starches as compared with root starches. When the natural or untreated starch granules are boiled with water at atmospheric pressure, the granules swell and finally burst. When the temperature exceeds 140° F. there exudes a very viscous colloidal solution of the amylose. The amylose passes into colloidal solution as soon as the outer cell sac has been broken open. The amylopectin, when heated with water, becomes a gelatinous mass, but does not dissolve except at temperatures well above that obtained by boiling at atmospheric pressures. The swollen and ruptured cell sacs which formed the outer wall covering of the starch granules can be observed floating about in the solution of amylose. The presence of these suspended structural forms retard flow, thereby adding to the viscosity. These skeletal forms are fragile and will be progressively broken down as the boiling is continued, or they may be broken down quickly by violent agitation.

Harrison points out that with sufficient dilution these skeletal forms will settle out before being broken up, and that a measure of the bulk or volume of these separated cell sacs will be found to be an index of the viscosity of the starch solution, and, therefore, of its sizing or stiffening value.

"Ermen has called attention to the fragile character of these structural forms by stating that it is impossible to return and rerun the same starch solutions through a viscometer and obtain concordant results, since with the continued agitation incident to reheating, stirring and repouring, more and more of these skeletal forms are broken down, resulting in a loss of viscosity. The number and size of the undissolved particles remaining, after a given procedure of heating or bringing into solution by chemicals, depends upon the concentration of the solution, the time of boiling and the violence of agitation. Obviously then, to have a solution of any degree of stability, it is necessary to boil sufficiently or to break down by other means these skeletal forms. These changes in rate of flow are recognized in laboratory testing, but sufficient cognizance has not been taken of this feature in factory usage of starch solutions. As a result there is in factory practice a widely varying rate of flow or viscosity change. Such change vitally affects the amount of starch solution added to or retained by the fabric treated. When the viscosity is lowered the solution flows more freely and less will be retained by the paper or textile fabric which has been submerged."

T. C. Taylor, in another paper of the same symposium volume, stresses the lack of homogeneity or stability in "solutions" such as are obtained by heating or cooking starch for considerable periods of time as is usually done in practice. "While partial swelling is accomplished with relative ease it is by no means uniform, some granules changing greatly and some only slightly for a given treatment; there are always, however, still others which lose their form completely and break. This break or rupture releases more or less of the starch material, part of which goes into solution and part of which does not.

"A starch paste as ordinarily made, therefore, is a mixture of granules of starch in various degrees of 'swollenness,' as well as some soluble and insoluble starchy material from the ruptured granules. This state of affairs can be demonstrated easily by experimental methods, the swollen granules can be seen under the microscope either directly or after staining with gentian violet."

By specially regulated hydrolytic treatments, a type of soluble starch can be obtained which does not settle out on cooling as is usually the case with the thin-boiling starches. Nivling describes the use of soluble starches in general for aiding in clay retention when coating paper, as a protective colloid in resin sizing of paper and in color thickening.

The sizing of cotton warp yarns is one of the most general textile processes in which large quantities of starch are used. Woolen yarns are starch-sized to a much lesser extent. Farrow describes the process of tape sizing as follows: "When gray yarn enters the hot size on a tape frame it is not immediately wetted by the paste but is merely in contact with it at the extremities of the fibers which project farthest from the yarn surface. Wetting takes place slowly and by the time the yarn comes to the squeezing roller it is enveloped in a sheath of size which is partly squeezed off and partly driven into the yarn by the pressure at this point. The extent to which the yarn is invaded by the size depends on the temperature—the higher the temperature the better the wetting—and to some extent on the weight and surface of the squeezing roller. A light squeeze leaves a fairly thick external coating of paste on the yarn and fails to drive size deeply in. A very heavy roller causes the yarn to be sized throughout, while the external coating is decreased in thickness. A roller covered with soft flannel leaves the yarn heavily coated, a wrapping of cotton cloth over the flannel on the hand disperses the paste and produces lighter sizing. The yarn passes on from the sow box and is dried over cylinders or in a hot air drying chamber."

Mechanism of Size Penetration or Coating

Nivling likewise describes the sizing process as the formation of a bonding or protective sheath. "Spun cotton or woolen yarns have free ends of fibers projecting. The laying of these projecting fibers to prevent intertwining and the covering of the yarn by a sheath or wall of size to protect against chafing, are the first essentials for weaving. The cementing down of the projecting fibers requires a strongly adhesive and sufficiently viscous fluid, so that the fibers will be held in contact with the yarn until drying effects a permanent bond. The added strength given to the yarn depends upon the bonding of fiber to fiber. The smoothness and elasticity depend upon the *character and quality* of the sizing solution; that is, upon its adhesiveness and its ability to form a smooth continuous film. The laying of the projecting fiber depends primarily upon the viscous quality. The thickness of its surface wall or coating depends upon both viscosity and concentration. The high viscosity essential to effectively lay the projecting surface fibers prohibits more than the most superficial penetration by capillary absorption."

Illustrations are given showing the extent of penetration into various yarns. The ends of the yarn are teased open and the whole treated with iodine solution. The location of starch as an outer sheath is thus conclusively demonstrated.

Some have been inclined to lay more emphasis on the effect of capillary attraction, considering that the starch was absorbed by capillary attraction in the interstices between the individual fibers.* R. H. Pickard, director of the B. C. I. R. A., stated in 1918: "The fundamental question as to whether the size penetrates the fiber or is

*Cathcart, Cotton 88, p. 821 (1924).

merely pasted on to the thread does not appear to have been settled." The question was also brought up at the second annual meeting of the American Association of Textile Chemists and Colorists (1922) in a discussion following a paper read by Dr. Cathcart on starch sizing.

Although capillary attraction is no doubt a minor factor in ordinary warp sizing there are instances where this effect is more important. Nivling refers to the sizing of linen handkerchiefs in this respect. The requirements here is that every strand have a wall or fiber which will give the feel of greater substance and yet have all the spaces between the strands free from starch. Also, the film remaining on the surface must be sufficiently thin and transparent that the color of the fabrics will not be obscured. For such service a freely fluid, transparent solution is desired, which will penetrate to the innermost recesses and leave only a thin film on the surface.

A case of the opposite extreme is the back-filling of certain twills, where maximum stiffness and a complete filling of the spaces is required. To this end a stiff plastic starch paste is applied and pressed into the spaces by pressure rolls.

Water Content of Sized Yarns

Regarding the water content of sized yarns, Farrow states "Starch films absorb about twice as much water as cotton, and figures are available which enable the water content of a sized yarn containing a known amount of starch to be calculated for any state of humidity of the atmosphere.

"In Table I are given the observed water contents of a sized yarn consisting of 90.6 parts of cotton and 9.4 of starch over a range of relative humidities:

The figures in parentheses are those calculated from the composition of the yarn and the hygroscopic power of cotton and starch separately. The values given are for material which has been dried before exposure to the moist atmosphere. If brought from a saturated state to an atmosphere of moderate humidity, starch, cotton, or sized yarn retain appreciably greater quantities of water than those tabulated. For instance, the maximum steady water regain of starch film brought from saturation to 70% relative humidity is 19.5%.

"At higher temperatures starch and cotton absorb less water than that shown, so that goods packed in a confined space such as a sealed case become *effectively moister* as the temperature rises, since the water which they should give off cannot escape. It may well be that this result is one of the causes of the growth of fungi (mildew) which occasionally damages goods shipped to tropical ports."

Farrow also mentions the matter of breaking strength and extensibility as affected by the sizing process. It is stated that mere increase in breaking strength is relatively unimportant in minimizing breaks in the loom.

TABLE I

Regains of Starch, Cotton and Sized Yarn at Different Humidities. (Parts of Water to 100 Parts of Dried Substance at 20° C.)

Relative humidity	20	30	40	50	60	70	80
Raw cotton	3.3	4.1	4.9	5.7	6.8	8.0	9.5
Starch film	6.2	8.2	10.1	12.0	14.3	17.2	20.7
Sized yarn 9.4/90.6.....	3.8(3.6)	4.7(4.5)	5.8(5.4)	6.9(6.3)	8.0(7.5)	9.2(8.9)	10.9(10.5)

The Isoelectric Points of Wool and Silk

By L. Meunier and G. Ray

(Translated from Comft. rend. 184, 285-287, 1927, by Chas. F. Mullin, Textile School, Clemson College, S. C., and M. C. D'Amour, Converse College, Spartanburg, S. C.)

Various methods have been adopted by different investigators to determine the isoelectric points of wool and silk. In the following work a two-gram sample of scoured and sulphur bleached wool or degummed silk was placed in 100 c.c. of a buffer solution, the hydrogen ion concentration varying from pH 1.0 to 10.0, until equilibrium was established, which required about forty hours.

The samples were then centrifuged to remove the excess of water, the wool for five minutes and the fibroin for fifteen minutes, in closed tubes at 2,500 r.p.m., through a circle of about 14 or 15 cm. radius. The apparatus used was that of Meunier for the determination of the isoelectric point of demineralized collagen, described in the *Jour. Soc. Leather Trades Chem. 9*, 200 (1925). This readily gives the weight of the swollen fiber, and, by subtracting the weight of the absolutely dry fiber, the amount of water in combination with it is obtained, from which the amount of swelling is determined.

The results thus obtained are summarized in the curves of Fig. 1, the pH at equilibrium being plotted as abscissae and the corresponding swellings as ordinates. The samples used for the work upon wool consisted of both fiber (or yarn) and cloth. Both were *sulphur bleached* and washed with distilled water until the ash content was less than 0.1 per cent. For the silk, boiled-off tram, equally well washed with water, was used. As the figures obtained for the yarn and cloth check perfectly, this appears to substantiate the correctness of the results.

Examination of the curves shows that:

1. In the case of wool there is a distinct minimum of swelling at about pH 3.6 to 3.8.

2. In the case of silk fibroin, the minimum of swelling is much less distinct than with wool. The silk curve is flattened over a considerable pH range, but a minimum swelling can be located at about pH 4.2.

3. As the swelling of proteins in aqueous solutions of acids or bases is due to the formation of ionizable salts of the protein which exert internal osmotic pressure, the curves indicate that while wool possesses a distinctly amphoteric character, silk is considerably less active and combines with both acids and bases to a considerably smaller extent, especially between pH 3.0 and 7.0.

4. The fact that fibroin is less sensitive to changes in hydrogen ion concentration indicates that there are less free amino and carboxyl groups than in keratin. This point was investigated by a modified Van Slyke method (applied to soluble proteins) for the determination of free amino nitrogen. After the action of nitrous acid, limited to two hours, the average amino hydrogen found in keratin was 0.2% and in fibroin 0.07%. Further experiments upon the action of quinone and hydrolytic enzymes upon wool and silk confirm the above results.

5. An examination of the curves in Fig. 1 is of interest in connection with the shrinkage of wool yarn and cloth on milling in baths of variable hydrogen ion concentrations. The curve for wool indicates that the minimum of felting and shrinkage occurs in baths of a pH corresponding to the isoelectric point of the wool.

Translator's Note

The greater activity of wool in combining with both acids and bases, over that of silk at the same pH, indicates not only that there are less free amino and carboxyl groups in fibroin than in keratin, but that the internal linkage of the fibroin molecule or aggregate may be stronger than that of keratin, and therefore that fewer of these groups are available for combination, as the pH of the solution deviates from the isoelectric point.

The isoelectric point of wool has been given as about pH 4.8 by most investigators and that of silk at about pH 3.8. However, these will undoubtedly vary considerably with the previous history of the sample under test. In the present case we know little in regard to either sample except that both were scoured and that the wool was sulphur bleached. Undoubtedly most or all of the other investigators have used unbleached wool for their tests and this may account for the apparent low isoelectric point of this wool sample. However, both the scouring and the long water washing may also have had some effect upon the results obtained.

In the textile industry it has long been known that silk is considerably less sensitive to both acids and alkalies than wool, the latter being the most labile of all natural textile fibers, and the accompanying curves very clearly indicate just why this is so. This is of interest in connection with all of the wet processes of the wool and silk industries, but particularly in explaining why less difficulty is encountered in applying the vat dyestuffs to silk than to wool, as well as why silk is not usually dyed as heavy a shade in the acid dye bath as wool, etc.

Qualitative Tests for Rayon Goods

[EDITOR'S NOTE.—*There are at the present time four distinctive types of rayon, each of which exhibits more or less characteristic reactions with various reagents and chemical treatments. During the last year or two, however, manufacturers and users of rayon, in their endeavor to increase tensile strength, resistance to water, evenness of product, and in other ways improve the value of their output, have resorted to various treatments of the fiber after it has been spun, and also modifications in the process of manufacture, which have to some extent confused the results of any systematic scheme for their detection.*

For instance, the recent examination of a fiber, which presumably was of viscose origin, gave the typical reaction of nitro silk and also of cuprammonium silk. In fact, the indications were sufficiently marked to have readily led independent workers to have reported the product as being any one of the three.

The accompanying statement, however, which has been submitted for publication, gives a rapid and satisfactory method of procedure where the fibers are typical and none of the confusing elements referred to above has been introduced.]

ALL men connected with the rayon industry occasionally desire to know just what type of rayon is present in some particular fabric. Oftentimes these men are not chemists and do not have time or facilities to carry out an elaborate series of tests. The three following tests will enable such men to determine accurately within five minutes the type or types of rayon present in an unknown sample.

Test No. 1

Burn about 4 inches of one or more strands of yarn. If an odor of burning feathers is given off, it is real silk. If a hard black ball is left attached to the unburned part of the yarn, it is acetate rayon. If it burns very rapidly and leaves no ash, it is either nitro, cuprammonium or viscose rayon.

Test No. 2

Moisten three or four strands of yarn with water and treat with a few drops of a solution of concentrated sulphuric acid containing 1 per cent of diphenyl amine. If it is nitro silk it will turn blue instantly and will dissolve slowly to form a blue solution. The other three rayons—namely, acetate, cuprammonium and viscose—are unaffected by this test.

Test No. 3

Immerse for about ten seconds in a 1% solution of carminic acid to which five or six drops of ammonia have been added. Rinse slightly in cold water. If the sample is viscose rayon, it will be stained a light pink. If cuprammonium rayon, it will be dyed a deep red. Other possibilities have been eliminated by the first two tests.

Practical Hints on the Production of Bright Colors on Textile Fabrics

Part XXXVI

Another Mordanting Process—The Equipment, Its Construction and Operation—The Slop Padding Process—The Equipment Employed—Other Padding Pastes

By RAFFAELE SANSONE

(*Continued from page 359*)

IN another process employed for producing bright shades with basic colors on cotton, the properly washed and bleached material is given one or two passes in a bath containing Turkey Red oil, neutralized with ammonia and diluted 1 to 4 with water free from hardness, using an apparatus constructed on the principle shown in Fig. 1.

This machine contains a pair of squeeze rollers A and B, the lowest of which revolves in the treating bath, contained in a wooden trough T of special shape. This trough is furnished with a pair of lower submersion rollers, a large let-off tap, a closed steam-heating coil, and in some cases even a raising and lowering arrangement for leaving thoroughly free the squeeze rollers A and B. The short supporting shafts of cylinders A and B are set in well lubricated ball-bearings, the lowest of which remains stationary at the bottom of long slots on frame F, while the upper slides up and down and is continually under the action of two iron rods; the pressure of these is regulated by a pair of hand-wheels S, levers L and weights W.

The cotton goods to be padded (C) are rolled on a wooden beam, the shafts of which turn in lower slots under the action of a light brake, which regulates the tension. On the front of frame F is placed the spreading arrangement J, furnished with copper bars having a slightly rounded surface, and supplied with lines in two divergent directions; while at the rear is placed a pair of high arms M, supporting the cloth-folding arrangement R. The latter is supplied with a turning rectangle for depositing the material in uniform plaits on a lower table, or directly onto a small hand truck, ready for carrying to a hot air drying machine, where it is dried at a low temperature, and steamed for one hour, in the small ager shown in Fig. 2, with one-half atmosphere of pressure.

This consists of a large iron chamber C, of rectangular shape, placed on a low cement base. The lower portion of chamber C contains a perforated double bottom which encloses a narrow compartment supplied with closed steam radiators for the heating, and a perforated copper tube for the introduction of live steam. The portion of the ager above such a compartment is open. It is lined with a perforated iron wall. On the double bottom of chamber C is fixed a pair of iron rails, communicating with rails on the outside placed on the high cement platform P, in such a manner as not to interfere in any way with the closing of the iron door D, which hangs on two small upper iron wheels X, moving on a strong iron rail R held in solid supports. This door can be attached to the body of the heating chamber by two series of five fixing arrangements supplied with large screws easily manipulated by hand.

The light iron framing F runs on the rails, where the material to be aged is hung on small hooks to form high uniform plaits. Frame F is easily pushed in the ager, or pulled out from this, when necessary. The aging operations are not difficult to perform. After loading frame F with the fabrics, entering in chamber C, and closing and fixing door D, steam is turned on, at first in the closed steam radiators below the double bottom, and later when the interior of the ager has been warmed to a certain temperature (70° C. to 75° C.), controlled by a conveniently placed thermometer, the mercury bulb of which re-

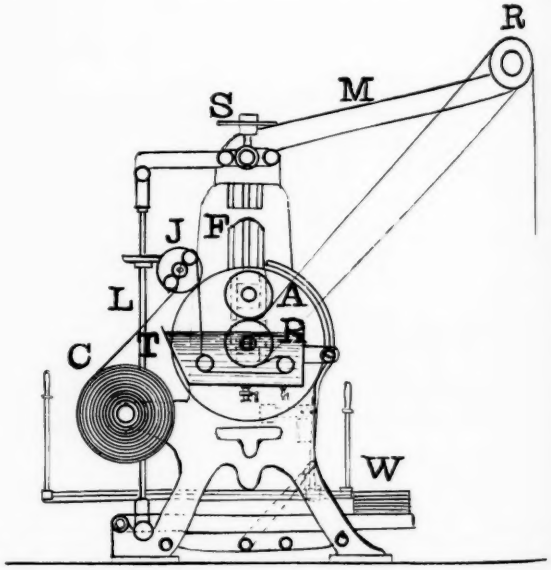

FIG. 1

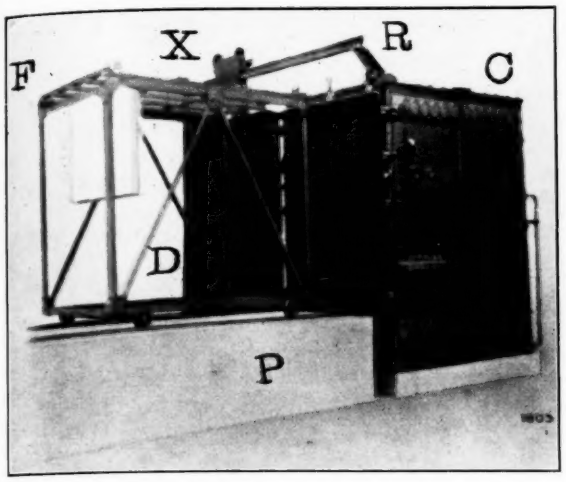

FIG. 2

mains inside chamber C; live steam is introduced in the open serpentine coil. This makes its way through the perforations in the double bottom and double walls and comes in contact with the goods, creating a certain pressure controlled by a small dial on the outside. After the necessary time of treatment, the live steam is turned off, also the heating through the radiators. Door D is then opened and the goods are carried before a padding machine, often constructed on the principle shown in Fig. 3.

This consists of two solid iron frame-sides A and E, set firmly in the floor of the works, and supporting between them three squeeze rollers, N, O, T, the central of which is of copper-plated iron, while the upper and lower are of India rubber. The end-shafts of such cylinders turn in continually lubricated ball bearings; the driving being conducted from the central cylinder O, by special gearing R, all of which is enclosed in protective guards.

On the front of the machine and before the nip of cylinders T and O, and at the back before the nip of rollers O and N, is placed a small copper-plated iron roller, by means of which all danger of injuring fingers is prevented, without interfering in any way with the fabric being treated. Pressure is applied to cylinders N, O, P, through double levers which react principally on the lower cylinders.

Trough V, placed below the cylinders, has two compartments, one of which serves for collecting the liquid pressed out, while the other treats with a bath of acetate of alumina, and has two binding rollers to provide for several passes and pressings of the material. Before entering the treating bath the fabric is passed on a spreader that smoothes out all plaits or folds. The wetted material can be wound on a wooden beam, or transformed into pieces by a special plaiter fitted at the back of the apparatus.

The plant is started or stopped by moving hand-lever Q, while hand-lever I serves to raise the pressure on the lower bowls, which then remain under the action of springs, and are set a small distance apart from one another and from bowl N; the arrangement facilitating the entrance of the beginning of the fabric to be impregnated, or of the cotton tapes if these are used. Vat V can be taken out or placed in position with the greatest ease on the lower light iron platform Z.

The bath of acetate of alumina used in the above case measures from 5 to 10° Be., and is prepared by dissolving 9 parts of sulphate of alumina of first quality in 65 parts of water free from iron, adding 2.85 parts of sulphuric acid at 66° Be. and after a little time 18 parts of acetic acid. The mixture is then strongly agitated, adding later slowly, and at 35 to 40° C., 8.90 parts of aluminate of soda. This is soon dissolved, during development of carbonic acid. The bath is, however, left to rest for some time, before separating the clear liquid through decantation. One hundred parts of acetate of alumina are thus obtained which possess a certain stability, and can be diluted before use to 5 to 6° Be.

The goods treated as above are fixed at 45° C. in a bath containing 10 parts of chalk per one part of bath, rinsing then thoroughly and dyeing with the basic colors from a water bath rendered slightly acid with acetic acid.

The treatment with the acetate alumina can be combined with the rinsing and chalking processes by using a plant constructed as shown in Fig. 4.

This consists of a long iron case or vat H, of a metallic composition resistant to rust, the length of which is strong, while the width is a little above that of the broadest piece of cotton cloth to be treated. Vat H is set in the floor of the dyehouse at a convenient height for the operators. It contains on the front a small extra trough R for a preliminary wetting with the bath of acetate of alumina, and seven compartments for treating with greater abundance of the acetate, for rinsing and for chalking. Trough R and the seven compartments are followed by squeeze rollers E, E, E, D, V, I, L, A to eliminate the excess of bath

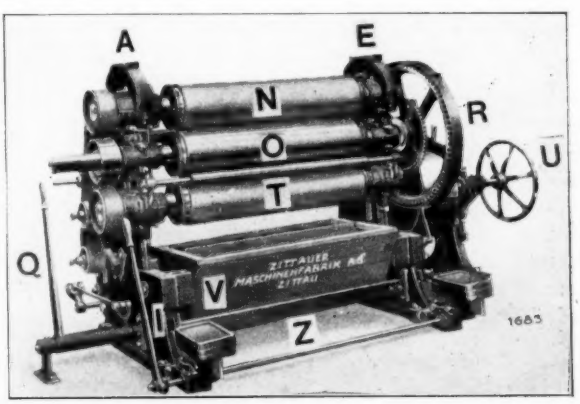

FIG. 3

in each case. The last of these is surmounted by a plaiter P for forming pieces. The plant is driven by the long iron shaft Y, which works several pinion wheels, and has step pulleys, through which three different speeds can be attained.

The Slop Padding Process

The slop-padding process, limited originally principally to print works, is now largely employed also in large cotton cloth dyehouses, where the operatives do not mind working on the padding machine with thickened pastes, or performing special drying and steaming operations. In this instance a printing color is often made up by bringing first into solution 15 parts of a suitable basic dyestuff, often a Rhodamine, in 350 parts of water, and then preparing a thickening with 20 to 25 parts of wheat starch, which is made up with 50 parts of water into a uniform dough, adding then slowly and during continual stirring 500 parts of water, and boiling until a semi-transparent gelatinous mass results, in which the color solution is incorporated when the bath has reached 70 to 70° C., agitating after this until cold and adding 75 parts of acetate of alumina at 12° Be.

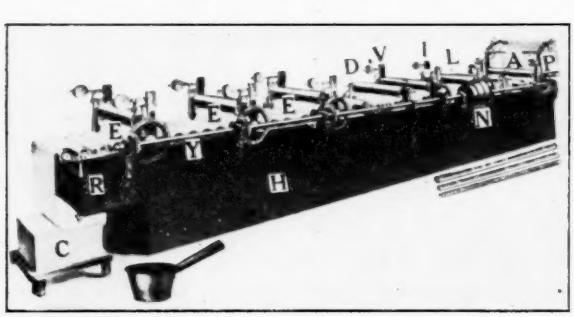

Fig. 4

The cloth is padded with the above dyeing and filling solution, using a machine constructed on the principle shown in Fig. 5.

The piece of equipment contains a large wooden bowl L, placed so as to remain for one-half in impregnation trough T, and an upper copper-plated iron bowl U serving principally to press the material. The first of such bowls is driven by a large pinion wheel, turned in its turn by a smaller toothed wheel and a pulley.

Bowls L and U are contained in a solid iron framing F, and the end-shafts of the lowest L are contained in fixed ball-bearings; while the upper are in movable ball-bearings, which remain under the action of levers and weight, regulated by upper hand-screws H.

The cotton fabric to be padded is entered from a wooden beam B, placed between lower slots on the front of the machine, and leaves this on a second wooden beam G, placed above a turning roller O, worked by a large and small pulley at the most convenient speed.

On leaving the above machine the rolls of material

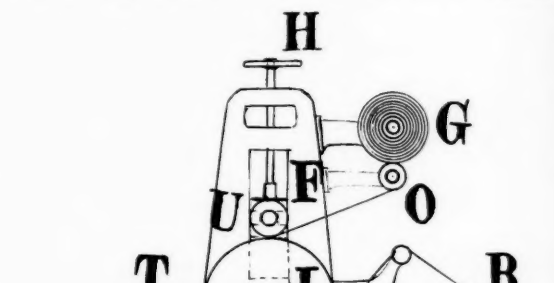

Fig. 5

are carried to the drying plant, which is sometimes constructed on the principle shown in Fig. 6.

This contains six large copper-plated iron drums, turning in bearings fitted in the solid iron frame F in such a manner as to occupy as little space as possible. One of the bearings of each drum receives the steam destined for the heating, while the other delivers all condense water forward, which is eliminated through a steam trap. The whole plant is driven by pulley P and many pinion wheels. Several guide rollers are furnished in the positions most suitable for utilizing best the heated surface of the drying drums, and ar-

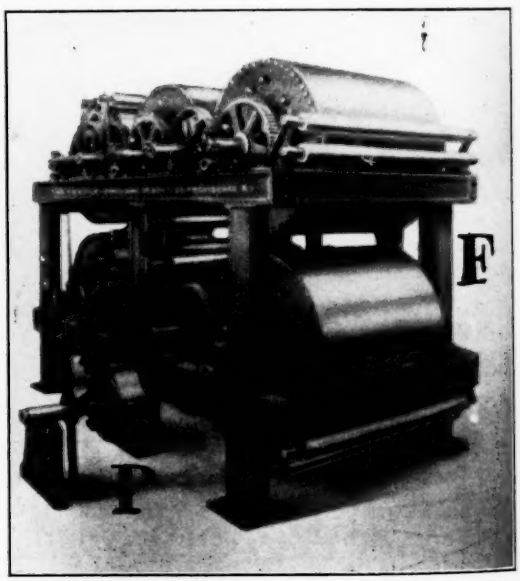

Fig. 6

ranging that only the reverse side of the cloth comes in contact. The drums are often covered with a cloth envelope to prevent soiling. The roll of wet cotton cloth is placed in lower slots, and remains continually under the action of a light brake which reacts on one of its short end-shafts; after drying it is wound on an upper beam moved by the sustaining bearings.

After the drying conducted as above, a steaming is made to follow in a cottage steamer constructed as shown in Fig 7, the essential portion of which is a horizontal boiler C, supplied with a heavy iron door D. This can be opened sideways with the assistance of a strong hinge and an upper arrangement, having small wheels running on an iron rail. It is closed hermetically against the body of boiler C by many short rods with hand-screws. Boiler C has a perforated double ceiling serving to collect all drops of condensed water formed, and delivering these to the bottom, where live steam is introduced in several parts at a time by a perforated iron coil below a double bottom formed of slips of wood placed at a short distance from one another. Boiler C has also a pressure

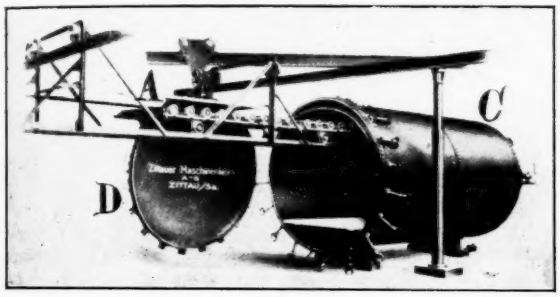

FIG. 7

gauge and a safety valve, which blows whenever too much steam reacts on the goods.

The steamer differs markedly from the usual type, in that it contains an upper carriage A, on which the goods are hung on square-shaped rollers, each containing a piece with or without a protective fabric. The rollers are given a slow rotary movement by means of a device placed on the closed bottom or base of boiler C.

When the above treatment has been concluded, the material is passed on the continuous drying plant shown in Fig. 8, which contains the two large drums A and B, for giving a preliminary drying before delivering to the clips of the pair of endless chains C. These clutch the selvedges, and while stretching the material slightly over its gray width, carry through a one-story hot air drying oven O, relaxing all action when a drying has been attained sufficient to prevent shrinking; after which plaiter P does its work, forming pieces on a low wooden table, not visible, and the goods can be finished later by passing through the calendar shown in Fig. 9. The latter contains an

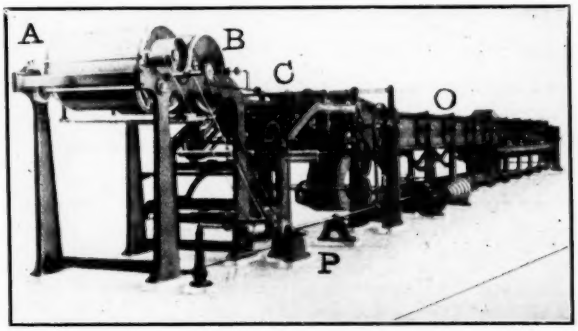

FIG. 8

upper and lower cotton bowl and a central polished steel cylinder. The material is entered and batched off on the front of the machine and remains under the continual observation of the operatives.

OTHER PADDING PASTES

With another padding paste a thickening is prepared with:

20 parts of wheat starch and
800 parts of water, incorporating
15 parts of Rhodamine G dissolved in
200 parts of water, and agitating until 50° C. have been reached, when
15 parts of 50% acetic acid are added, following soon after with
40 parts of acetate of chrome at 20° Be.

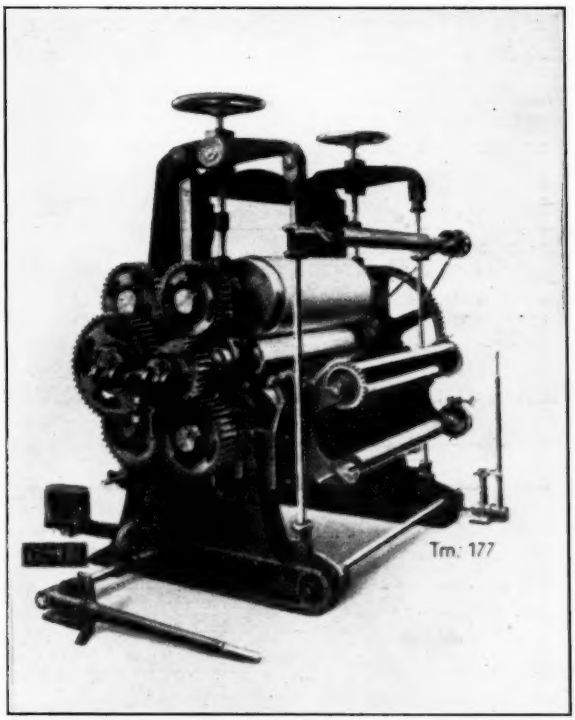

FIG. 9

The cloth is padded with the above mixture, dried, steamed one hour without pressure, again dried and finally finished.

A very bright pink is produced by padding a paste containing:

30 parts of Phloxine,
640 parts of water and a cold thickening containing
50 parts of wheat starch,
1,000 parts of water,
15 parts of olive oil and
80 parts of 50% acetic acid.

When a uniform mass has been produced, 90 parts of acetate of chrome at 20° Be. is mixed in, and the cotton fabrics can be treated.

(*To be continued.*)

Alizarinesulphonic Acid Ester

A Water-Soluble Alizarine Preparation

By E. GEBAUER-FULNEGG and ILONA EISNER

Chemical Technology Laboratory, University of Vienna, Vienna, Austria

SINCE very early times alizarine has been an important dyestuff because of the brilliant red shades of extreme fastness which it produced on textile fibers. In recent years, however, there has been a constant decrease in the use of this valuable substance, not because of its displacement by better dyes but because of the complex process of application which involves high costs, loss of time and uncertainty regarding the results. It seemed probable that these difficulties could be overcome and the process of dyeing simplified by altering its chief disadvantage, its insolubility in water. Durant and Huguenin * were among the first to develop on a practical scale a method of converting vat colors into water-soluble derivatives by esterifying the corresponding leuco compounds with dibasic acids. The products produced in this way are hydrolyzed and reoxidized on the fiber. The commercial importance of this process is limited by a number of disadvantages both in the preparation of the esters and in their use, the most troublesome operation being the control of the very sensitive leuco derivatives during esterification. It is for this reason that these derivatives of vat colors are expensive. German patent application No. 19,666—IV. 8m. mentions a sulphonic ester of alizarine. This type of compound has been touched upon already in a more general way in French patent No. 557,666. It was the practical and theoretical interest inherent in such an ester that led to the present investigation.

Preparation of Alizarinemonosulphonic Acid Ester

In attempting to produce a water-soluble alizarine derivative it is not necessary to proceed to the esterification of the leuco compound as in the case of the vat colors. It is rather to be expected that at least one of the two hydroxyl groups will be capable of direct esterification. As reagent chlorosulphonic acid in the presence of dimethylaniline or pyridine was chosen because such mixtures seemed to be of general applicability for this type of esterification and have been used for various reactions—as, for example, with *N*-acetylindoxyl, from which Schwenk and Jolles † prepared the corresponding sulphuric acid ester. The monoacid esters thus formed are strong acids of the type $ROSO_3H$, capable of forming numerous salts.

When this reaction was applied to alizarine, a monosulphonic acid ester was formed, as expected, and it was found that this ester in the presence of strong alkali was divalent, giving salts of the type $R\text{-}OX\text{-}OSO_3X$, while with the weaker bases, pyridine or dimethylaniline, only the hydrogen of the strongly acid group was replaced by the positive radical. The neutral salts formed with strong acids were decomposed, even by acetic acid, to give monometallic salts corresponding to those obtained from organic bases. All the salts of the ester undergo hydrolysis when treated with concentrated hydrochloric acid and the sulphonic acid radical is completely removed, the reaction being quantitative. This characteristic reaction was employed as an analytical method in order to check the sulphur value obtained by the method of Carius.

The esters are remarkably stable toward alkalies.

Procedure—Twenty grams of alizarine are thoroughly mixed with 30 grams of dimethylaniline and to this a mixture of 180 grams of dimethylaniline and 40 grams of chlorosulphonic acid, prepared by cooling with ice, is added. After standing two hours at 50 to 60° C., the reaction mass is made alkaline and the excess of dimethylaniline is removed by steam distillation. Then the uncombined alizarine is filtered off after acidifying with acetic acid. From this acid filtrate the monosodium salt of the alizarine monosulphonic acid ester can be salted out as golden yellow leaflets. If the filtrate is made alkaline, the disodium salt of the ester is precipitated with sodium chloride, which can be purified from sodium acetate by fractional crystallization. Thus, 12 grams of the disodium salt are obtained.

(*Continued on page 396*)

* Swiss Patent No. 102,540 (1921).
† Biochem. Z., 68, 347 (1914); 69, 467 (1915).

Proceedings of the American Association of Textile Chemists and Colorists

The American Association of Textile Chemists and Colorists

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FORTY-SIXTH RESEARCH COMMITTEE MEETING

THE forty-sixth meeting of the Research Committee of the American Association of Textile Chemists and Colorists was held at the Engineers' Club, Boston, Mass., Friday afternoon, May 11, 1928. The following members were in attendance: Prof. L. A. Olney, W. S. Williams, Dr. Joseph F. X. Harold, H. W. Leitch, W. H. Cady, Walter C. Durfee, R. W. Hook, H. Meyer, R. F. Culver, H. Christison, G. A. Moran, K. B. Moore, P. H. Ripley, H. D. Clayton, W. E. Hadley.

Letters of regret for being unable to attend this meeting were received from H. A. Barnes, Ed. F. L. Lotte, Prof. C. E. Mullin, P. J. Wood, Dr. W. M. Scott and A. E. Hirst.

The report of the previous Research Committee meeting was read and accepted.

Considerable time was spent in discussing the relative merits of the Fugit-ometer and the Fade-ometer when equipped with humidifying and ventilating devices, and it was finally conceded that there is but little difference between the results obtained with the two instruments. Several attempts have been made to accurately measure temperature and humidity with the Fade-ometer but with varying degrees of success. The opinion was expressed that the light intensity was reduced at least 10% and the fading slowed up very considerably when making use of the Fugit-ometer. It is understood that the Bureau of Standards will shortly conduct trials with the Fugit-ometer in comparison with Fade-ometer.

It was believed that the best way to arrive at a decision as to the value of humidity and temperature control in the operation of these instruments would be to have them housed within an inclosure where the temperature and humidity would be accurately controlled, and this to be done within a short time.

Reference was made to the carbons used in the Fade-ometer Lamp, and it was pointed out that, while other carbons have been used, it was the opinion that those furnished with the Fade-ometer undoubtedly represent an excellent grade.

CONSTRUCTION OF WASHING MACHINE DISCUSSED

The Research Committee authorized the securing of bids from various sources upon a washing machine to be built in accordance with specifications which related to size, shape and preparation of the jar, the position of

the jar in relationship to the shaft, and rate of and method of controlling the rotation of the shaft.

It was the opinion if the Association specified the above requirements any properly constructed machine would give satisfactory and concordant results. After considerable discussion it was decided that plans for the machine should specify twenty jars.

Offers had been received from different manufacturers who would be glad to assume the responsibility for the making of the machine, but it was felt that the Association could better hold control, thus being able to distribute the machines at cost.

R. F. Culver was designated to obtain specifications on a suitable name plate which could appear in a prominent position on the apparatus, the name plate to feature the name of the Association.

It was voted that figures be obtained from various concerns and that the chairman of the Research Committee be authorized to have twenty-five large or twenty-five small-size machines constructed, if deemed advisable after going over the figures secured.

The various sub-committees reported as follows:

Dr. Scott sent for discussion a tentative method for determining the "Fastness to Degumming of Dyed Silk."

Mr. Moran, chairman of the Fastness of Cotton to Washing, reported progress.

Mr. Christison, chairman of the Fastness of Wool to Washing, advised that considerable more work would have to be done before anything definite could be reported in regard to fastness to water, potting and cross dyeing.

Dr. Hans Meyer was appointed chairman, and Dr. Jos. F. X. Harold and W. R. Moorehouse members of a committee to cover the matter for a report on Fastness to Stoving and Crocking.

W. H. Cady, chairman of Committee on Fastness to Light, reported that Series 5 will be published within a short time.

It was thought advisable to extend the work upon standard methods, and Professor Olney will shortly appoint a sub-committee on the method of determining the amount of sizing in different materials as well as of the weighting in silk.

The questionnaires recently sent out by the secretary are being returned and several valuable suggestions regarding the coming Annual Meeting and the Year Book are being received, and these will be considered at the next meeting which will be held June 15.

It was suggested that publicity be given to the desirability of various dye and chemical concerns distributing uniform sized sheets, cards, books, etc., in order that same could be more easily filed.

W. E. HADLEY, *Secretary.*

MAY MEETING OF THE NEW YORK SECTION

THE May meeting of the New York Section of the American Association of Textile Chemists and Colorists was held on May 25 at the Elmwood Country Club, Paterson, N. J.

Dinner was served to about sixty members and guests, after which the annual election of officers was held. S. L. Hayes, the retiring chairman, was given a rising vote of thanks from the members present for his service in the past year, and the following officers were elected for the coming session: Chairman, Daniel P. Knowland; vice-chairman, Percy Kingsbury; treasurer, J. J. Sokolinski; secretary, P. H. Stott.

The following were appointed as the Sectional Committee: S. L. Hayes, W. A. Kingman and H. F. Herrmann.

P. J. Wood was elected as the section's representative on the Nominating Committee for national officers The following local committees were appointed: Membership Committee—G. Wolstenholme, Otto Poetsche, C. A. Puller, W. E. Hall and C. F. Schaumann; Program Committee—P. H. Stott, L. C. Scott, H. F. Herrmann, J. F. X. Harold and P. J. Wood.

A special committee was appointed to take care of the arrangements for the annual outing to be held at a convenient date in June. The committee included: L. C. Scott, chairman, C. F. Schaumann, J. S. Lange, H. F. Wilmot, C. A. Puller and M. D. Reeser.

With Mr. Knowland in the chair, the speaker of the evening was introduced, Prof. D. D. Jackson of Columbia University, who spoke on the "Use and Disposal of Water in Industrial Plants." The lecture was illustrated by some very interesting slides and proved to be a most interesting talk.

The chairman's introduction of the speaker and a full report of Professor Jackson's address and of the discussion follow:

Chairman Knowland—When I was informed that it was up to me to secure a speaker for this meeting, I did not know what would be a good subject to bring over to Paterson, particularly here. Naturally, thinking of this club, I thought of water, and when I thought of water I naturally thought, Who can best tell us about the good and bad points of water? My thoughts then turning to my good friend Professor Jackson, I asked him if he would speak to us and he accepted. He said he had a very fine set of slides he would be glad to bring along and that he could give us an illustrated lecture on the uses and disposal of water in industrial plants.

It gives me great pleasure to introduce Professor D. D. Jackson, of Columbia University, Professor of Chemical Engineering. (Applause.)

Proceedings of the American Association of Textile Chemists and Colorists

Water Supply and Drainage for Industrial Plants

By Prof. D. D. Jackson

Chemical Engineering Department, Columbia University

I HAVE been asked to give a general resumé of water and drainage treatment, which is a rather large subject to discuss in twenty minutes, the time allotted me, but I shall do the best I can with it.

The first problem in connection with the treatment of both water and sewage is the question of sterilization. That involves the use practically of either hypochlorite of lime solutions or liquid chlorine, chlorine gas which is injected into a portion of the water, and then carried through to the main stream.

The sterilization of drinking water you all probably know about. [Slide] This is the usual type of apparatus for moderate-sized sterilization plants. The solutions of hypochlorite of lime are stirred in one of these tanks and run off into a little tank here, where you have an orifice and a definite amount of solution above it, so that you have the same amount flowing through in proportion to the volume of water to be treated.

That sterilization of drinking water started only a few years ago. I remember when I first started this work in New York City, Dr. Wiley said that he was bound he would stop it because I was putting poison in the water supply and Wiley, you know, had an axiom that "poison was poison" regardless of amount. That being the case, of course, a few ounces of common salt was found to be poison.

At all events, that process is used in almost every city in the country at the present time and it has cut down the typhoid rates and the deaths from intestinal diseases among children enormously, and has probably been one of the greatest advancements, in a sanitary way, that has ever happened to this country.

Sterilizing with the Minor Flow

[Slide] The use of liquid chlorine came along very shortly after, and there you have the 100-pound cylinder connected up with an orifice, and since this is under definite pressure you can go through a definite orifice and run through a certain definite amount of solution—it doesn't make much difference what amount of water you use because you are using a definite amount of hypochlorite—and that is called a minor flow. That minor flow, with the proper amount of chlorine gas mixed with it, gives you the sterilization of the bacteria in the water.

[Slide] That applies also to drainage. Wherever your drainage goes into a water supply, the treatment must include at least sterilization, and does include such treatment. There are many types of treatment of drainage for towns and factories, where the drainage goes into a stream which eventually goes into a water supply source either of the township or the factory.

We have for the removal of suspended matter—microorganisms in the water, or suspended matter of any kind, clay, or what not—the simplest type of treatment, the slow sand filtration, of which this is a simple specimen. These are filters about half an acre each, where the water flows gradually through sand which has been carefully sifted, and that not only removes the suspended matter but any deleterious bacteria which may be present.

[Slide] The first plant of that kind was built in London, about 1850, for the purpose of clarifying the Thames River. They hadn't the slightest idea it was going to do anything except clarify it, and a few years later they discovered that the typhoid rate of London had been tremendously reduced, and investigations showed that was due to this type of filtration.

In this country, because we have to do things much more rapidly, or think we must, than anywhere else, we introduced what is called the rapid type of sand filtration, or mechanical filtration. That old type of filter had to be drained down and cleaned by hand, and it took sometimes two weeks to get it started again. With the new type of mechanical filter we have a system of drains underneath whereby the water may be backwashed. This, however, is the slow sand filter, with the cover on top, to prevent freezing in the wintertime. That is not necessary, except in very cold climates.

[Slide] The question of aeration is one which has to do with the removal of gases, hydrogen sulphite, carbonic acid, and what not, and also the oxidation of any iron which may come from ground waters. If you have a ground supply which precipitates out an iron flock, a yellow-brownish flock, it is necessary to aerate it before it is filtered, and that is done most easily by pumping it up through pipes, in this manner, and allowing it to splash down on the surface of the water. That takes out the carbonic acid or hydrogen sulphite that you get in a great many places and replaces it with the oxygen of the air. It also oxidizes any of the iron present so that it may be very easily filtered.

[Slide] Types of aeration of this kind (this is one below the Croton Dam) are used not only for letting down the head—because in the Ashokan system we would have about 300 pounds of pressure, which would be too high in the city, so the head is allowed to be let down in this way and at the same time we get a purification of the gases and reduction of the organisms.

[Slide] The whole supply of Jacksonville, Fla., is splashed in this way to relieve it of hydrogen sulphite gas, which, as you know, would be very disagreeable in the water supply. These types of aeration are used more particularly for large types of supply but may be readily

used for factory purposes, where you want to get rid of gases, or where you want to oxidize the iron.

Removing Lime and Magnesia

[Slide] In connection with the treatment of water for removal of lime and magnesia, we have a good many types of filters for that purpose. This is a municipal supply in northern England, where the water has 20 degrees of hardness, and in that section a law was passed that no supply should be delivered of more than 10 degrees of hardness. They put in a plant of this kind, which is a zeolite process, for filtering the water through this zeolite sand and reducing one-half of it to zero and then mixing with the rest of it, bringing it down to the legal 10 degrees.

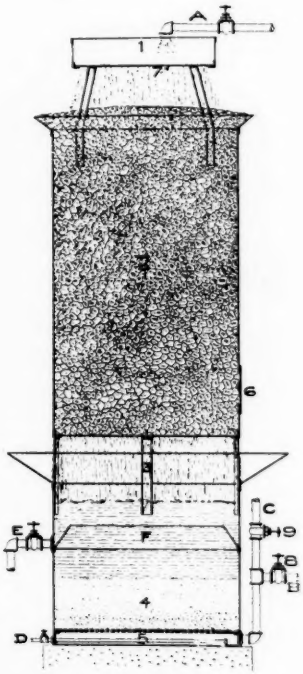
[Slide] The zeolite sand, as you know, entirely removes all of the lime and magnesia, and this is particularly important in textile work. If you have any lime or magnesia present in the water (they exist in all natural waters), you have magnesia soaps which float on the surface of the water and give a gummy mass which is the cause of seconds, particularly in silks or in light-colored goods.

I want to show you particularly this type of plant, which is used abroad rather extensively for the removal of iron. In New Jersey we have many ground supplies which are troubled with iron and manganese precipitations, and all through Germany and a good part of the north of England they have the same trouble. That is best taken care of by first aerating, not in this case by throwing it into the air as I showed you before, but by sprinkling on top of a coke filter, or filter of inert material of any kind, and by that sprinkling oxidizing the iron so that it has an opportunity to be held back on a second filter. In that way you will have aerated and removed the iron at the same time. That is a matter of very considerable importance in not only textile work but a great many other lines of manufacture, where precipitates of this kind are deleterious, particularly in chemical manufacture.

In a good many places in Germany they have made a checker work of brick, piling bricks on top of each other in an open way, and sprinkling the water on top of that. perhaps over a space 20′ x 20′ x 20′, and then passing it through a filter, the object being to oxidize the iron first, precipitate it, and then filter the iron out. This form is used quite extensively, not only for factories, but for some of the municipal works in Germany. In Tegel, just outside of Berlin, a similar type is used.

[Slide] They are troubled over there more often with manganese than we are in this country. That precipitates in just the same way as the iron does and is taken out by the same process. You have there a dark brown or blackish precipitate instead of the reddish or yellowish precipitate of the iron. There is also such a thing as getting white or light yellow precipitates of aluminum, which are removed in the same way.

This is the plant at Dresden in the process of construction. Dresden has a beautiful infiltration gallery along the shore of the river, very fine, soft water, but with a heavy precipitate of manganese, and in this case the manganese is removed by using what is called a



Reisert Iron Remover

manganese zeolite, which is very effective indeed in such removal. It was found, however, that by splashing the water and passing it through the same filters, using graded sand, the same result could be obtained. That, of course, would be very much cheaper than the use of the manganese zeolite, so this graded sand is now used for that purpose. When they draw off the washings from these filters, they look like thick ink and the water itself comes through perfectly clear.

Equipment for Smaller Installations

[Slide] In connection with mechanical filtration for smaller installations, we usually have an upright boiler-shaped filter, which can be used up to 10 feet in diameter. Above 10 feet in diameter it is more economical to use the filter horizontally, and filter through in this way. These filter shells are used to conserve the pres-

sure. You would normally use a gravity filter, which you can easily take care of, and see what is going on at the top, but where the pressure is to be conserved you do not need double pumping; you use a shell of this kind, conserve that pressure and reduce it only a very few pounds.

[Slide] Here below we have a system of strainers, the water passing down through these strainers and into the main pump well. When you want to wash, instead of taking a long period, you filter by means of a small pump, pressing the filter water up through there and raising the muck which has accumulated on the surface, and that overflows and is washed away.

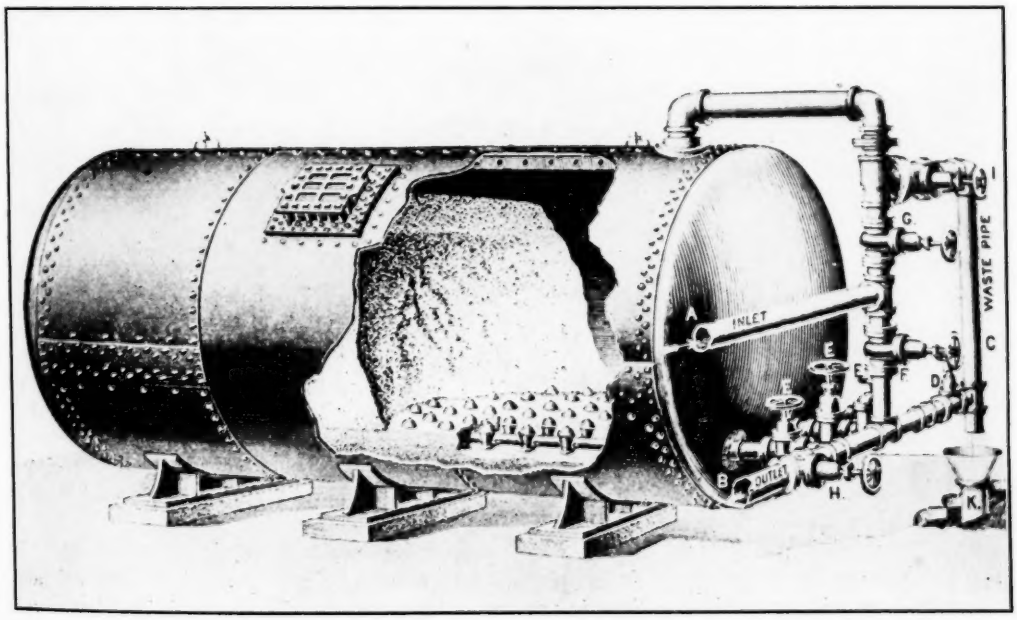
[Slide] There are different types of mechanical filters, this one with a stirring device which is not much used now because we find that a high pressure wash water will take the place of the mechanical stirrer and render it rather unnecessary.

[Slide] This shows you how the washed water acts, the backflow of the wash water raising the *"schmutz decke,"* as the Germans call it, from the surface of the filter and flowing it over into the drain, thus in a few minutes getting rid of the accumulated muck, and then you can reverse the flow and proceed again.

[Slide] This mechanical filtration is very largely due to Professor Leeds, of Stevens Institute, New Jersey, whom probably some of you remember as professor of chemistry there. He spent a great deal of his time and much of his money in developing this process. I think he spent most of his money on it, as a matter of fact. It took a long time to get the thing developed.

The mechanical filter as used for factory purposes may be installed in the form of a series of tanks in this way, with the loss of head gauges at the top, to indicate when the friction is such that it is necessary to wash. When you get about 8-foot loss of head, you backwash the filters. That is a system which delivers about 3,000,000 gallons a day. The same type, of course, would be used for smaller or greater amounts, simply increasing the number of tanks. In this case, the precipitate aluminum sulphate is used to form a quick filtering medium on the surface of the sand, and whether it is slow sand filtration or mechanical filtration, the work of these filters is done in the first quarter inch of sand. In other words, whether it is organic, in the case of the slow sand filter, or whether it is mineral, as in the case of the mechanical filter, that gelatinous film is what collects the bacteria and the suspended matter, and that is what does practically all of the work.

[Slide] The first really up-to-date mechanical filter with all of what are still the modern appliances was built in Little Falls, N. J., and the Little Falls plant, which was first designed for 30,000,000 gallons, is shown here. That has been added to materially since, but is still a very up-to-date installation. At the time it was installed it was ahead of its time. There you have the concrete construction, with the filter-house here, the ends of the filter beds shown on either side, the operating tables along here, the filters outside of this construction and underground, but easily accessible from the inner portion of the plant. There you can draw off the filtered and unfiltered water and examine it at those tables.



Horizontal Pressure Filter

The Dry Feed Process

[Slide] Here is a very up-to-date plant which has been recently installed in Defiance, Ohio, and here you have several rather new operations. In the first place, in this building we have what is called the dry feed process. Instead of making a solution and having rather extensive tanks for that purpose, a cone-shaped device is arranged with a revolving disk at the bottom, and the finely divided alum and lime is first relieved of its moisture by heating so that it is perfectly dry. That has been the difficulty in dry feeding before. If you have a perfectly dry powder you can feed very accurately. I am rather surprised that that process has not been installed for the continuous delivery of other chemicals as well. It is perfectly dry, and by feeding through a cone with a revolving disk at the bottom you can get a continuous feed of a dry chemical very accurately. That was one of the first things installed there, and it is important. After feeding the water with the lime and alum, it passes by baffles in this mixing chamber and goes over to the precipitating chambers. There we have something new as well. We have generally had to take the sludge from the bottom of these chambers by drawing down and pumping it out. In this case it is done with a series of cones and an open-joint pipe at the bottom, and the sludge can be drawn off from the bottom of this into the river without drawing down the water itself. That is effecting quite a saving of water.

When you add lime to water for drinking purposes, you always get a little of the normal carbonate of lime, and in that case there is always a flat taste to the water. That taste is due to the fact not that the water contains caustic, but carbonate, and not bicarbonate of lime. That, of course, is brought about by the lime feed and is remedied over here by bubbling through a small amount of carbonic acid, which comes from a small furnace. The gases are carried from the furnace through a purifier, and then bubbled through here so that there will be no normal carbonate of lime left; it will all be bicarbonate. In this manner you regain the flavor. Then it passes through the usual type of mechanical filter and to the pump well.

[Slide] This is in Louisville, Ky. The water is stored here and an alum feed at this point. The alum passes around a long distance so as to get complete coagulation and partial precipitation before it goes to the filters.

[Slide] This is one of the best types of feeds for partial softening of water where you don't need to get complete removal of the lime and magnesia. You can get very great reduction by adding definite amounts of lime and soda from tanks which are run by revolving wheels. You get a flow of lime and soda in proportion to the flow of water through here. That causes a precipitation of the hardening elements of the water, and here we have a decreased velocity, which causes the material to precipitate at the bottom, then also a decreased velocity as it comes up and goes out. Those are installed in a great many factories and also along the lines of railways, particularly the Erie road, where they have tremendous hardness, in southern Ohio, Illinois and places of that kind, and where for prolonged sections no water can be obtained of less than 25 or 30 degrees of hardness. With that very large amount of hardness present, the lime soda process is usually preferable from a standpoint of cost. There it is taken down to perhaps 5 degrees of hardness, which is all right for a boiler for locomotive purposes.

[Slide] This is an installation in one of the large silk mills in Brooklyn, the Kayser plant. It shows the treatment of water for softening purposes by the Permutit system, where the water passing rapidly through this zeolite sand is freed of all its lime and magnesia, down to zero, and therefore it does not cause any precipitation in the textile goods.

Invention of the Zeolite Process

[Slide] Dr. Gans, who was the inventor of that process, was a chemist who discovered that water passing through certain layers in nature was relieved of its lime and magnesia, and he found that this particular type of mineral would do the work. Freiherr von Volhardt, who lived in the same town, Dresden, tried for six months to get that man to patent the process, and he finally succeeded in getting him to give him a half interest if he would patent it and take care of it and look out for it. He produced the zeolite, and I am told that Dr. Gans received a half-million dollars for his share.

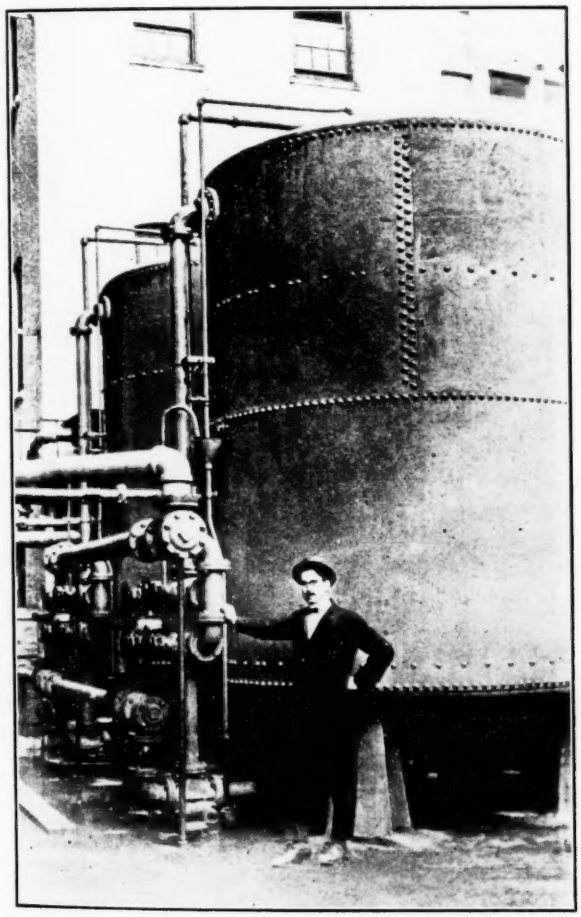
To get to the question of the treatment of drainage, the best possible treatment of drainage, or factory waste of any kind, is to dump it into a stream and let it flow away. Where the tidal effects are sufficient, that can be done without causing any difficulty. One of the main things to consider in locating a factory is where you are going to put this drainage, and how much it is going to cost to treat it, if you haven't a sufficiently large dilution medium for it. In Liverpool they have about 18 feet of tide, and all they need to do is to run the drainage of the entire town into this big reservoir. Then, when the tide goes out these gates open automatically—they are kept closed by the pressure of the tide—and the whole drainage of the town gets away without any treatment whatever; you can see that that is a very cheap and a very good Scotch method of handling it. (Laughter.)

You have, for instance, the Passaic valley system, with a pretty large capacity. The best possible means of taking care of color waste would be to put it into that sewer

system. That is, of course, provided that you don't use a large amount of sludge along with it. If you have a screening system to remove the sludge, there is no reason why the liquid itself should not be delivered into such a drainage system which goes down in the salt water and cannot cause any trouble.

There is always, from the inspection point of view, a great deal to be seen when you put an extremely small amount of color into a river, and these color wastes are perhaps as hard to take care of from that point of view as anything we have to deal with, and if they can possibly be taken care of through a large sewer that is really the ideal way.

In New York City we have the entire drainage system going in with comparatively little purification, with purification only in spots. That is a tremendous asset to the city and will be for some time to come. The time has come when local treatment plants have had to be installed, but the carrying to sea would involve some two hundred and fifty or three hundred million dollars, and in the meantime the interest on that money will take care of what we call a redistribution of the drainage; that is, if it gets too concentrated in one spot we can deliver it by pipe over, for instance, from the Harlem River into the North River (which has been done), where the North River can take care of it.



Zeolite Softener Installed at Kayser Silk Company, Brooklyn, N. Y.

Types of Screening System

[Slide] The screening systems that are most used are, first, revolving screens which are made of linked rods, attached so that they will travel over this drum at the end. The drainage passes through in this direction, and this is constantly rising up, and what is screened out is scraped off at the bottom and taken care of here. Those revolving screens are used extensively abroad. We have one of them at the end of Canal Street, in New York.

One of the types of screens for factory purposes is the Riensch-Worl screen, developed in Germany. There you have a revolving disk set into the liquid, which is traveling in this direction, and as this slowly revolves a film of the suspended matter is deposited on that rim. The screen has the appearance of a Welsh hat. And on the rim of the hat is deposited this film from the suspended matter. They have a law in Germany that no factory or town can run into a stream a liquid containing particles over 3 millimeters in size. This screen will reduce it to two without any difficulty at all. And since this works on ball-bearings, it requires very little power. This portion of it is only for the high water. It takes care of the rise and fall of the liquid. Most of it comes out on the rim of the hat, is scraped off by this rapidly revolving series of brushes at this point, scraped into a series of buckets which carry it to the surface. That removes the suspended matter, which is the chief difficulty of most factory waste, and that is all that is required in many places where the stream is large enough to take care of such drainage easily.

[Slide] This is the system for the city of Dresden, and is the only system required for that city, a system of revolving Riensch-Worl screens (all of which are handled by one man) revolving on ball-bearings. In front is a stilling chamber, so that the liquid goes slowly onto those screens, deposits just like a piece of filter paper on the screens, and the liquid passes through to the other side and out into the stream.

So far as I know, except for one or two factory installations, this has not been properly installed in this country. If you have the liquid going onto a Riensch-Worl screen rapidly, you have material congesting, with open spaces in one portion of the screen and bunches of it in another. Then you get a very poor result. That is the usual treatment in this country. We have many in-

stallations of that kind and they don't work well, because the plant owners have not paid a little more to get a stilling chamber in front of the screen.

That particular type of filter is fine for heavy wastes, like wastes from leather works and similar plants. I have installed a number that have been running for many years to remove the heavy suspended or slimy material from wastes of that kind, and in the case of leather works the entire installation consists of a Riensch-Worl screen followed by chlorination, a screen to remove the suspended matter, chlorination to kill any possible anthrax germs that might be present. Anthrax germs are liable to be in most of our works of this character, not only in foreign hides but in domestic hides. I think that is true of most leather factory wastes. And, of course, we get trouble below from animals, but that can easily be taken care of by chlorination.

[Slide] We have several methods of handling the factory wastes containing a large amount of organic matter, which can be destroyed by bacterial action. One method is to put it into a tank like this—large or small, depending upon the amount—and allowing it to stand. The time element in passing through this tank must be from four to twelve hours. That gives you what is called a septic action. That is, the bacteria are using up the organic matter in the absence of oxygen, and we have the septic bacteria doing it. To break it down, the bacteria gasify it and liquefy it, so that there is little or no sludge to be disposed of, and that sludge is of a peaty character. That we call septic action. The effluent, however, is quite foul-smelling and usually requires further treatment.

The Double-Story Imhoff Tank

[Slide] Here is another series of tanks where the sludge is removed by a squeegee which travels on these rails and carries it to the far end, where it is dumped.

[Slide] This shows an actual installation of what is called the Imhoff tank. These tanks are double-story. The liquid flows along the top slowly, and in doing so settles out the sediment through this slot in the bottom. The bottom compartment is a septic tank, where septic action can go on for a long period. It admits of a continuous flow, and this type of installation has been used quite extensively in this country and all over Europe.

[Slide] That shows its design. It travels in this direction. The sediment flows out here. It accumulates here and is disposed of bacterially over a long period, while this goes on flowing continuously. The reason for that pipe is that in the destruction of the sediment large amounts of gas are given off and they come up through the side here into the atmosphere, and those are chiefly hydrogen and carbonic acid. There is not much odor from them, and the rise of the gases does not disturb the flowing liquid. So you are just practically disposing of all the matter which would sediment in the slow flow of the material.

[Slide] These are Imhoff tanks in the city of Essen, where you have an enormous amount of factory waste, along with the drainage of the city itself, and you will note that they are in the center of the city, with habitation near by. The gases come out in these slots along here, and the flow is continuous through the top tanks.

[Slide] There are a great many types of factory wastes which, if disposed of locally, must be treated with some form of chemical, and usually sulphate of aluminum or lime; or it may be that acid or alkaline will cause the necessary precipitation. Chemical treatment is, as a rule, expensive and is avoided if possible.

Contact Filter or Trickling Filter

This plant was a chemical treating plant in the city of Worcester, Mass., where we had a large amount of acid sludge from the Washburn & Mowen Iron Works (pickling works). We had an enormous amount of iron precipitate which came down with the rest of the drainage, and that involved, we thought at the time, chemical precipitation. Chemicals were run in at this point, and run by these baffles into these settling basins, and the effluent was drawn off at the far end. That has been largely replaced, however, and is operating differently at the present time. The chemical precipitation method is still used in the city of London, but it is admitted to be not the best method of handling the situation. There is a committee working on that at the present time.

[Slide] With the flow from the septic tanks, the further treatment is by means of two methods, either what is called the contact filter or the trickling filter. These are contact beds, simply large areas of crushed stone. That stone, when first put in, does not do anything at all with the drainage, but after it has been seasoned each piece of stone has a film of gelatinous organic matter on the outside. That has very strong enzymic action that has a tremendous effect upon the septic waste. The liquid is allowed to flow in for two hours, but never comes to the surface. It stands for two hours, and then is drawn off, and as it is drawn off it will require perhaps a dilution of one to one to make it non-peatrousible, so that it will cause no trouble. When it flows in there it may require a dilution of one to forty or fifty, and the contact with this enzymic gel produces that tremendous result.

[Slide] The trickling filters, on the other hand, are very rapid in their action. They require only a few minutes for the liquid to be sprinkled upon the surface and travel right on down through and out, and in that same period they accomplish even a little better result than the

contact beds. There you have the same enzymic action going on from the gel, which is on the surface of these stones, and you have the trickling and the aeration as well. This has to be housed, or else located where the wind action will not carry odor, because whereas the contact beds do not produce odor at any distance at all, these are liable to cause a great deal of trouble from wind action.

[Slide] The last slide here shows you a trickling filter such as is used in Baltimore for the entire drainage of the city; this particular installation is in Reading, Pa. The septic sewer passes through main pipes and through uprights to a sprinkler on the surface of this crushed stone bed, travels in a few minutes right down through it, and goes out almost perfectly purified, so far as its requiring dilution is concerned.

That is one of the most astonishing effects imaginable. You can't realize that in a few minutes this very foul and odoriferous effluent requiring forty or fifty parts of diluting water can be put into a condition where it requires practically no dilution, or only one to one dilution.

Thank you. (Applause.)

Discussion of Water and Drainage

Chairman Knowland—We all appreciate Professor Jackson's very instructive talk, and I am quite sure that it must have recalled to your minds some questions that have occurred to you some time in your factory experience. I am sure he will be glad to answer any question that you would like to ask.

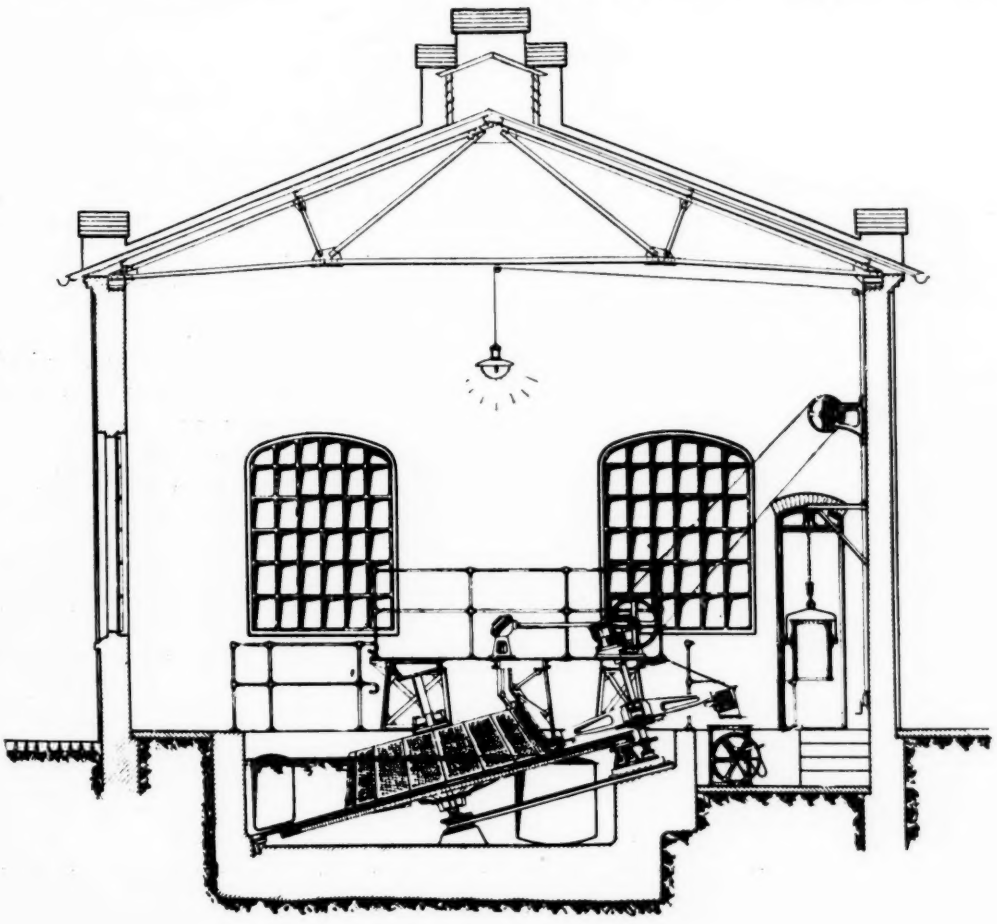
Mr. Stott—I should like to ask Professor Jackson if he is familiar with the sewage disposal scheme in the city of Bradford, England? The reason I ask is because at one time I was quite interested in the material they recovered from sewage, which was known as Bradford wool grease, and which we distilled and obtained from it oleic and stearic acid. I wondered if Professor Jackson knew anything about the particular scheme they have in that city.

Professor Jackson—No, I am afraid I don't. I have been in Bradford but don't remember seeing their sewage works. What type are they, do you know?

Mr. Stott—No, I don't know anything about them.

Chairman Knowland—Are there any further questions?

Mr. Wood—I wonder if Professor Jackson has had



Riensch-Worl Screens

any experience with the treating of factory wastes from dyehouses which contain such complicated mixtures as acids and alkalies and soap wastes and color. I have been told that in some places they have met with a great deal of success in having a mutual precipitate, one or the other, but I have never seen that carried out in practice.

Professor Jackson—There has been a large amount of experimental work done in trying to get mutual precipitation of these various liquids. The trouble is you have so many different kinds of liquids and colors and there is such a change going on at different times of the day that it is probably the most difficult problem there is in the disposal of waste of any kind. I think a plant of that kind should be located where the waste could be simply screened and put into either a large trunk line sewer or disposed of in a large volume of water. It is practically impossible to precipitate or decolorize the general mixture. You can get mutual precipitation. You can sometimes get a good result for a little while.

So far as I know, there hasn't been very great success in the continuous treatment of an effluent of that character.

Chairman Knowland—Would any other gentleman like to ask Professor Jackson any questions?

Mr. Hayes—Did I understand you to say that in a mechanical filter practically all of the work is performed by the first quarter of an inch?

Professor Jackson—Yes.

Mr. Hayes—May I ask, then, why they have 5, 6 and 7 feet of material?

Professor Jackson—They formerly had 8 or 10 feet—in fact, 15 feet—of material. They now have about 2½ feet of sand for the purpose of supporting that film so that it won't get out of shape and you won't get holes down through it. But the sand filters, whether slow sand or mechanical filters, have been demonstrated to do practically all this work in that film at the surface, and the object of the sand underneath is merely to support that film so that it won't get broken.

Mr. Sussmann—Mr. Chairman, I should like to ask Professor Jackson if any study has been made as to the reclaiming of any of these sludges or compounds that are sometimes obtained after disposal of the waste? As far as I know, they just either dump it on the ground around there, or, if compelled, cart it away. But is there any use made chemically of any of these wastes in a general way?

Professor Jackson—Copperas is so cheap, to start with, that it hardly pays to recover the sludge; when it is filled with all this organic matter it doesn't pay to recover it. With some other sludges, of course, it would pay to recover part of it.

Chairman Knowland—Are there any further questions you would like to ask Professor Jackson? If not, before adjourning the meeting I believe we should give Professor Jackson a rising vote of thanks.

. . . A rising vote of thanks was extended to Professor Jackson. (Applause.)

. . . The meeting adjourned at 9.50 o'clock.

Applicants for Membership

Active Membership

Barker, Wyss L., demonstrator, National Aniline & Chemical Company, Charlotte, N. C. Sponsors: C. H. Willard and K. Mackenzie.

Bick, Carl E., superintendent of dyeing, Real Silk Hosiery Mills, Indianapolis, Ind. Sponsors: A. J. Mease and A. T. Brainerd.

Jenkins, John J., president, Peuchot Color & Chemical Company, New York, N. J. Sponsors: Paul Chasse and W. Hales.

Schleicher, R. H., president, R. H. Schleicher & Co., New York, N. Y. Sponsors: W. Hales and D. P. Knowland.

Altenberg, Leo, Gaskill Chemical Corporation, Newark, N. J. Sponsors: J. F. X. Harold and E. Freedman.

Caspe, J., Gaskill Chemical Corporation, Newark, N. J. Sponsors: J. F. X. Harold and E. Freedman.

Wolstenholm, George, boss printer, Finco Dye & Print Works, Brooklyn, N. Y. Sponsors: D. P. Knowland and J. J. Sokolinski.

Junior Membership

De Vine, Richard, colorist, National Spun Silk Company, New Bedford, Mass. Sponsors: W. H. Wingate and George W. Searell.

Gurian, Louis, assistant to colorist, U. S. Customs Service, New York, N. Y. Sponsors: Geo. H. Davis and P. Fiebiger.

Scheuer, Edwin B., chemist, Geigy Company, New York City. Sponsors: D. P. Knowland and A. F. Wiehl.

Changes of Address

Booth, Herbert, P. O. Box 186, Long Branch, N. J.

Buettner, K. E., 5410 Harrisburg Boulevard, Houston, Tex.

Callahan, Cornelius A., 11 Sayles Street, Southbridge, Mass.

Guiterman, E. W., 337 Aycrigg Avenue, Passaic, N. J.

Hannant, Fred A., 290 Sagamore Street, Manchester, N. H.

Jaeger, Jr., Robert W., c/o Armour Soap Works, 1355 West Thirty-first Street, Chicago, Ill.

Kapp, B., 1140 Anderson Avenue, New York, N. Y.

Schmidt, E. H., 240 Warren Avenue, Palisade, N. J.

Deceased

Brainerd, Carroll L., 24 Orchard Street, Passaic, N. J.

SWISS DYE INDUSTRY IS IN A PROSPEROUS STATE

Dye Exports Figure Largely in Basle's Trade with Other European Countries and United States

INCREASED chemical exports from Basle, Switzerland, consisting in the main of aniline dyes were responsible for a considerable share of the prosperity enjoyed during 192? by the Swiss dyestuff manufacturers, according to a special survey from Consul C. M. Hatch of Basle, through the Chemical Division of the Department of Commerce.

Despite the keen competition in the dye trade, which appears to be growing stronger each year, the dye producers of Basle were able to score another increase in sales during 192?. The prosperous state of the trade was reflected in the activity of the stock market. At the close of 192? the shares of the Sandoz Chemical Works and the Society of Chemical Industry, two of the largest dye manufacturers in Basle, were quoted at a much higher figure than at the close of the previous year. The par value of these shares is 1,000 francs each, and on December 31, 192?, the shares of the Society of Chemical Industry were quoted on the local exchange at 2,825 francs, as against 2,568 francs at the end of 1926, and the price of shares of Sandoz Chemical Works was 4,400 francs per share, in comparison with 4,000 in the previous year.

The net earnings of the four important dye factories in Basle in 192? ranged from 25 to 42%, and the dividends paid to shareholders ranged from 12 to 25%. All of the stock of J. R. Geigy, S. A., one of the largest dye concerns in Basle, is owned by the Geigy family, and as this concern does not publish its balance sheet, its earnings can only be approximated. It is estimated that its net earnings in 192? were not less than 35%.

The capital, net earnings, and dividends in 192? of the three other important dye firms in Basle are shown in the following statement:

	Capital Francs	Net Earnings	Dividend
		%	%
Durand & Huguenin, S. A.	2,000,000	34	12
Society of Chemical Industry	20,000,000	25	15
Sandoz Chem. Works	?,500,000	42	25

Basle's Exports of Dyes Important

The chemical exports from Basle in 192? were valued at approximately ?0% of the exports from all Switzerland. The greater portion of Basle's chemical trade consists of aniline dyes, the exports of which increased in 192? by more than 20 per cent, as compared with the previous year.

Although there was a decrease of more than $200,000 in the export of dyes from Basle to the United States in 192?, the exports to all countries were valued at ?1,536,??0 francs ($13,810,100) as compared with 5?,040,215 francs ($11,011,620) in 1926 and 52,130,426 francs ($10,063,400) in 1925.

The increase during the past two years has therefore amounted to approximately 3?%.

Increased Trade with Germany and France

The healthy increase in exports during the past two years has been mainly due to the resumption of trade with Germany, which was entirely suspended for several years. The German purchases of dyes in 192? in this market were valued at 14,220,343 francs, as compared with ?,658,56? francs in 1926.

There was also an increase in the export trade with France from ?,823,513 francs in 1926 to 10,816,264 francs in 192?. The exports to France during the late summer months were very heavy in anticipation of the higher customs duties which became effective under the provisions of the German-French Treaty of Commerce.

The export figures for 192? in comparison with the previous year show that there was a decrease in the average selling price of dyestuffs. In fact, on most products the decrease in price was even more pronounced than is shown by the figures given, inasmuch as the exports are more and more confined to specialties, the prices of which are comparatively high.

The competition which Basle dye manufacturers have had to face in the United States, England, France, Italy and Japan has been intensified by increased production of dyes in those countries, thus rendering foreign producers less dependent upon Swiss dyes. Furthermore, some countries have introduced heavier import restrictions, such as the licensing system in England and higher customs duties in Japan. But in spite of the difficulties encountered, the Basle dye manufacturers have been able to increase their exports.

The figures heretofore given in this report relate solely to the exports of dyes from Switzerland, but on account of the import restrictions in many countries, the Basle dye manufacturers, in the past ten years, have established factories in various countries, and they are now supplying large quantities of dyes produced by their foreign factories directly to consumers in those countries. This fact does not appear in the figures mentioned herein. The foreign factories which have been established are owned jointly by the Sandoz Chemical Works, the Society of Chemical Industry of Basle, and J. R. Geigy, S. A. They are situated at Grenzach, Germany; St. Fons, France; Clayton, England; Seriate, Italy; Pabianice, Poland, and Cincinnati, Ohio. All of these have recently been improved and enlarged.

One of the outstanding features in the dye export trade of Basle during 192? was the resumption of

trade with Russia, which was interrupted several years ago. The Russian embargo against Swiss exports was removed in the spring of 1927, and since that time manufacturing and commercial circles in Switzerland have been getting in touch with Russia. It was late in the year before any deliveries of dyes could be made to Russia, but the trade for the year amounted to 360,813 francs, and there are good prospects that during 1928 Russia will again become a large customer for Basle's dye producers.

An agreement for the pooling of profits and losses has existed for several years between the Society of Chemical Industry of Basle; the Sandoz Chemical Works, and J. R. Geigy (Ltd.), the three largest dye firms in Basle. They are apparently well satisfied with existing conditions, and it would require an extraordinary inducement for them to change their present methods of doing business.

CHEMICALS USED IN THE MANUFACTURE OF PAPER IN CANADA

A recent report issued by the Dominion Bureau of Statistics, Ottawa, shows the following consumption of chemicals utilized in the manufacture of paper during 1926, exclusive of chemical and mechanical pulp:

	Tons	Value
Alum	19,040	$627,901
Casein	469	110,542
Clay	13,410	220,816
Dyes and colors	.....	295,138
Size	9,161	622,924
Whiting	243	11,316
Miscellaneous	.....	3,728,682

Of the total consumption of alum, Ontario is credited with consumption of 10,419 tons, Quebec and New Brunswick 8,395 tons, and British Columbia 590 tons. Similar data on the other groups are available in the Chemical Division.

INDUSTRIAL CHEMICALS IN VENEZUELA

The principal industrial chemicals imported into Puerto Cabello, Venezuela, during 1926, according to statistics which recently became available, are calcium carbide, caustic soda, and sodiuu silicate. The United States leads in the calcium carbide trade in 1926, having supplied 135 tons as compared with 89 tons from Germany and 75 from the Netherlands. During 1925 Germany occupied first place and the United States second. In the caustic soda trade receipts from the United States increased from 220 to 261 tons, while shipments from the United Kingdom fell from 414 to 234 tons. The United States' position in the sodium silicate trade is not as favorable as in the other commodities. Whereas shipments from the United Kingdom increased from 112 tons in 1925 to 147 in 1926, those from the United States fell from 25 to 23 tons. An additional 14 tons was received from the Netherlands in 1926. (Vice-Consul George R. Phelan, Puerto Cabello).

ANGLO-GERMAN GLAUBER SALT CARTEL

The German and British producers of Glauber salt have concluded an agreement of three years validity, regulating prices and dividing markets. It is stated that important consumers of the Glauber salt produced by a number of large factories on the east coast of England are the Swedish pump manufacturers, whose demand, due to Swedish industrial difficulties, has fallen off heavily. German factories are said to be less affected than others and to have plenty of orders on hand. Hence it is alleged that the agreement with the British producers was concluded in order to prevent disturbances in the world market. Unconsumed quantities will be stored at common account, thus enabling producers to hold prices at the usual level until the Scandinavian countries again appear as buyers of the normal amounts. This information is based on a report from Consul Hamilton C. Claiborne, Frankfort on the Main.

MAGNESIUM SULPHATE IN THE GERMAN RAYON INDUSTRY

Magnesium sulphate is extensively used in the German rayon industry by all factories employing the viscose process. According to this process, the liquid cellulose is forced through minute orifices into a special solution, where each single stream instantly solidifies into a silk-like thread which is later spun and woven. The solution contains a large percentage of magnesium sulphate. The relation of the consumption of magnesium sulphate to the output of rayon is said to be 4 to 4½ tons to every 1,000 kilos of the finished product. Thus a factory like the Vereinigte Kunstseide, which produces 10,000 kilos of rayon daily, might use as much as 45 tons of magnesium sulphate daily. Further information on this subject supplied by Consul Hamilton C. Claiborne, Frankfort-on-the-Main, is available in the Chemical Division.

DEVELOPMENT OF CELLULOSE ACETATE INDUSTRY PLANNED

The British Celanese Company, Ltd., for some time has been producing sheets, rods and various manufactured articles from cellulose acetate, and the production of this material is planned by a number of other companies. This concern also has organized a subsidiary for the manufacture of cellulose acetate glass, and is expected to extend its activities in still other directions, according to information from the Chemical Division of the Department of Commerce.

AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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PROFESSOR OF CHEMISTRY AND DYEING, LOWELL TEXTILE SCHOOL
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WANTED: PUBLIC SENTIMENT ON A LIVE ISSUE

TO the American public, even to many business men, the tariff is not a happy topic for conversation at any time, nor even a pat subject for after-dinner oratory. Indeed, perhaps most of us shy at any mention of the tariff for the very reason that it was once so popular with after-dinner Ciceros. Now, however, it has almost ceased to be a political issue, to judge from the current Presidential campaign.

This general indifference to a great national issue would be admitted by anyone without a qualm of shame, for the tariff viewed from any aspect seems as remote from all personal interests as the weather-cock on the town church. Yet a shift in the wind of tariff sentiment, like a veering of the weathervane, actually affects every person in the country regardless of his status in the business or social world. Readers of the REPORTER know how a vacillating tariff policy nearly ruined the American dye industry in its early days.

Right now there is every reason to be seriously concerned over the future tariff policy of the United States. There would be less cause for concern if the public were sufficiently informed and sufficiently keen and interested to declare itself in favor of adequate tariff protection. There would be less cause for concern if a larger majority of our manufacturers were working more vigorously to create such a favorable public sentiment. It is the good fortune of industry that at least one small group of vigilant business men are striving to maintain present American living standards. A meeting held in New York on April 30 under the auspices of the American Tariff League was attended by nearly three hundred of those business men. The present tariff situation was argued and discussed frankly from every angle. The peril of public indifference to the tariff policy and the urgent need of closer agreement among manufacturers as to what that policy should be were pointed out by more than one speaker at this meeting.

Why should these prominent American business men feel alarmed over the passive attitude with which so many of us regard tariff matters? We may ask, is there really cause for alarm? They would quickly answer that there is more than one cause. Although the tariff affects everybody, there is an amazing ignorance of the present situation. It is not known by many, for instance, that even though the present Fordney-McCumber Tariff, passed in 1922, is supposed to be protective, our importations of foreign goods for the past five years have been greater than at any previous period in history. Nor is it common knowledge that in spite of this condition a strong sentiment prevails in Washington for *lower* tariff rates and that this sentiment was boldly expressed not long ago in a resolution actually passed by the Senate —the McMasters Resolution—in which it was first resolved "that the United States Senate favors an immediate lowering of tariff schedules and tariff legislation, embodying lower schedules. . . ." This resolution was later amended and, as passed in its final form, resolved "that many of the tariff rates existing are excessive and that the Senate favors an immediate revision downward of such excessive rates, establishing a closer parity between agriculture and industry, etc., etc."

Agitation of this kind in Congress for a lowering of the tariff is not the only reason why those three hundred business men who met in New York were concerned about the future. They are not sure of the support they may get in Washington from the next Congress. When in 1922 the present tariff bill was passed, those who favored reasonable protection were able to state their case through the Congressmen on their side of the issue. But that valuable support has been dangerously weakened by subsequent changes in the membership of the Senate and of the House. As James B. Reynolds said at the Tariff League meeting, "There is an entirely new jury in Washington." Mr. Reynolds, a former assistant Secretary of the Treasury, gave the following statistics to prove his statement:

Of the ninety-six Senators who voted on the 1922 tariff bill, fifty-one are not there to-day. Fifteen States have an entirely new representation in the Senate. In the House, out of 435 who voted on the 1922 bill, 219 have been replaced. "Some of the best ones have gone," Mr. Reynolds observed, "and some who could very well be spared are still with us." This tariff expert pointed out further that the business man who is endeavoring to maintain a fair protective tariff has lost other strong allies—the farmer and the international banker. Both of these are now working *to break down protection.*

Are any more reasons needed to explain why the

present tariff situation is not one for sensible business men to shrug shoulders over indifferently? It is almost certain that revision of the tariff will come up at the next session of Congress. It is not less certain that the low-tariff clique will make a strong drive for downward revision. If that drive is to be repulsed by American business, a more active public sentiment favoring a higher tariff is absolutely essential. Nor should it be necessary to say that close agreement among the business men themselves will also be needed.

The means of creating a public sentiment that will support them must be worked out by those business men and manufacturers; and it must be worked out during the next three months. Here is what A. Cressy Morrison, chairman of the Executive Committee of the American Tariff League, told the group that met in New York:

> You as individuals can go down and get your rates if you have public opinion back of you, but you will need a co-operative organization to create a national sentiment in favor of protection or you will get nowhere. There is a vast difference between creating a sentiment for a tariff and getting rates.

In fostering the right kind of tariff sentiment among the men and women of American industry, members of the dyestuff and chemical trade and of the textile industry can be of valuable aid. Every opportunity should be used to stir up public interest in the need for protection. To quote August Merz of the Heller & Merz Company, who also spoke at the Tariff League meeting:

> The great trouble with all our tariff talk is that we talk too much amongst ourselves and too little outside. We should get out and talk to the public so that it can get busy and impress the man who is standing for election as to what is needed.

On the committee organized at the close of the meeting to assist in circulating public information on the tariff situation, the chemical industry is represented by C. A. Mace, secretary of the Synthetic Organic Chemical Manufacturers' Association; the silk manufacturers by E. J. Reugg, of Schwarzenbach, Huber Company; the rayon industry by S. A. Salvage, of the Viscose Company; woolens by A. L. Green, of the Farr Alpaca Company.

Every man in these industries should stand ready to support the commendable work of informing the American public on the relation between their present prosperity and an adequate protective tariff. That must be made a live issue.

Robert Armstrong has resumed his position as overseer of dyeing at the Fabyan Woolen Company, Medway, Mass., after an absence of several months. He succeeds Kearns Whaley, who has resigned.

OUR TRADE LITERATURE ABROAD

NEWSPAPER readers are treated almost every week to the comments of some English, French or German visitor upon the American scene. It is nothing extraordinary that many citizens of this land are not altogether pleased with some of these comments; though it is only fair to say that we always hearken intently to whatever the visitors tell us about ourselves. It follows, of course, that the views of some American visitors to Europe are similarly not agreeable to many Europeans.

Where our comments upon European *industry* are concerned, however, these little friendly disagreements are not so numerous as when they deal with social conditions. Thus we find our British contemporary, The Chemical Age, praising a detailed review of British chemical trade in 1927 prepared by Homer S. Fox, our Trade Commissioner in London, and recently issued by the United States Department of Commerce. An editorial in the Chemical Age describes Commissioner Fox's survey as "a document well worth the attention of British chemical manufacturers and merchants," and goes on to say that "the main facts are carefully set out and the inferences drawn from them indicate an informed and balanced judgment."

One good reason, we believe, why American surveys of British and Continental industries are welcomed on the other side in so friendly a manner is that no authoritative trade literature so well prepared and up to date is issued anywhere abroad. It is really surprising the way European trade journals depend to such a great extent on reports issued by the United States Department of Commerce for information about the industrial situation not only in their own countries but also in America. Evidently our literature on foreign trade is appreciated more highly abroad than at home. The value of our Government trade and industrial surveys would not be recognized by many American firms unless they were to move their business to Europe and wait until 1929 to obtain statistics on their 1927 trade.

CAUSTIC SODA IN EGYPT

The Egyptian Salt and Soda Company, a corporation controlled largely by British capital, holds a concession to exploit the mineral deposits of Wadi Natron oasis which is situated 120 kilometers southwest of Cairo. The area known as Wadi Natron covers 100,000 acres, and until recently reached only by camel, is now served by a narrow gauge railway. The company's products include caustic soda, soda ash, crude natron and salt. The lakes from which these materials are obtained are probably the oldest known sources of natural soda in the world. Approximately 10 tons of natron are extracted daily, but it is estimated that production could readily be increased to from 500 to 1,000 tons per day without appreciable effect on the deposits.

EXTRACTORIALS

There are still many mills struggling along with old equipment, without the improvements and without the efficiency developed by these improvements and new additions. The post-war period saw great improvement in the textile industry everywhere in this regard. Now, those mills which re-equipped are setting the pace in competition and the pace compels action on the part of the whole industry. There is no place in production to-day for antiquated machinery.—*Canadian Textile Journal.*

Although waterwheels do not make rivers run, nevertheless waterwheels out of use for a long period can become so rusted that they will not turn even when they are put in a river. So, also, chemists, who may be called cogs in the chemical waterwheel, are less apt to get rusty by being "turned" occasionally by the rivers of chemical thought. Power is thereby generated.—*Charles D. Hurd, in the Journal of Chemical Education.*

Many people seem to believe that the chemist really can do anything he wants to and do it right away, and that if he fails to supply what is needed as soon as the demand arises it is either because of laziness or just plain meanness. It is our fault that the public has this feeling about chemistry. We have shown them its magic and little else. It is time now to show them there is something more—that it usually requires a lot of hard work and a reasonable amount of time and capital before the chemist is able to perform magic.—*Dr. Frank C. Whitmore, in the Chemical Bulletin.*

Present-day training in industrial practice seems to be based largely on traditional lines. We teach the things that were and the things that are. I want to carry training into the things which may be. I agree that until a student appreciates and understands present method and practice, it is impossible to lead him into new avenues, but I suggest that men of the highest mental capacity should be trained beyond the traditional limits.—*Frank Hopkinson, in Journal of the Textile Institute.*

I do not think there is anything like enough consultation between the producers of fabrics and the person who makes up these fabrics into articles ready for use and the actual consumer. Closer consultation between manufacturer and maker-up are essential if greater effectiveness is to be secured.—*R. S. Meredith, in the Journal of the Textile Institute.*

Every application of science which results in lower production costs, through either a saving in labor or in raw materials, or which gives a new useful product or increases the use of old products, is directly beneficial to every man, woman and child living in the areas served by the industries making the improvement. The benefits extend even beyond that: they go to generations yet to come and to remote corners of the earth.—*Hugh Farrell.*

Clearly, there are far too many mills in this country. Many of them could be combined into units of a more efficient size . . . to the greater stability of the trade. There appears to have developed the idea that there is something peculiar about the cotton textile industry which renders substantial consolidations impracticable. But when we see the scale of consolidations that have proved eminently successful in other lines of industry, it is difficult to find any reasons why human ingenuity in the direction of industrial management must throw up its hands when it has to deal with the cotton textile industry.—*Walker D. Hines.*

PHILADELPHIA TEXTILE GRADUATES TO TOUR MILLS

The graduating classes of the Philadelphia Textile School will devote one week to a tour and inspection of certain mills and machine shops in New England. This annual feature of the commencement season will be under the direction of Edward W. France, director of the school, and Richard S. Cox, of the faculty. The tour will cover the following textile centers: Providence, R. I., Boston, Worcester, Mass., and Hartford, Conn. The students left Philadelphia on Sunday, June 10.

MEXICAN IMPORTS AND PRODUCTION OF SULPHURIC ACID

The official Mexican statistics reveal an increase in the imports of sulphuric acid during 1926 to 3,430 metric tons, as compared with 1,723 in 1925. The increase was due to the arrival of 1,634 tons from the Netherlands. The bulk of the remainder of the 1926 imports and practically all of the 1925 imports were supplied by the United States. The estimated output of domestic sulphuric acid during 1927 was: Cia. Mexicana de Explosives, S. A., 2,000 tons; Huasteca Petroleum Company, 6,000; Cia. Mexicana de Petroleo "El Aguila," S. A., 7,000; American Smelting & Refining Company, 5,000; Belick, Felix y Cia., 3,000 tons.

A plant was recently installed by the Hard Chemical Works, Mexico City, with an estimated daily capacity of five tons. The Huasteca Petroleum Company has a capacity of about 18,000 tons annually. Actual output has declined, owing to reduction in the company's refining activities. A recent report from Tampico placed the consumption by Huasteca at 10,000 tons annually and by El Aguila at 18,000 tons, according to the Chemical Division of the Department of Commerce.

ALIZARINESULPHONIC ACID ESTER

(*Continued from page* 380)

The unsatisfactory yield and the difficult fractional crystallization of this method led to the following simple procedure:

Ten grams of alizarine are dissolved in 40 grams of dry pyridine, and 20 grams of chlorosulphonic acid are added with careful cooling and good mechanical stirring. After standing one-half hour the reaction mass is treated with about 70 c.c. water and the insoluble yellow crystals are filtered off. They can be used directly for the padding process. When these crystals are heated in water for any length of time, they are hydrolyzed and alizarine is precipitated. This salt was therefore crystallized for the analysis from water *in vacuo*. The mother liquor was also evaporated in a vacuum and then made alkaline. Thus, on neutralization more of this ester was obtained. The total yield was 15 grams. The pyridine employed in the reaction can be recovered.

Analysis of this material agrees well with the figures obtained for a monopyridine salt of an alizarinemonosulphonic acid ester.

Analysis

0.1312 gram substance : 0.2743 gram CO_2 (0.0380 gram hydrogen)

0.1274 gram substance : 0.2665 gram CO_2 (0.0371 gram hydrogen)

0.0932 gram substance : 0.0545 gram $BaSO_4$ (method of Carius)

0.0854 gram substance : 0.0496 gram $BaSO_4$ (hydrolysis with concd. HCl)

0.1271 gram substance : 4 c.c. nitrogen (748.4 mm., 21° C.)

$C_{19}H_{13}O_7NS$. Calcd. : C 57.12, H 3.28, S 8.03, N 3.51%

Found : C 57.02, H 3.24, S 8.03, N 3.60%

C 57.05, H 3.26, S 7.98%

If the pyridine salt is treated with calcium or barium hydroxide or with the carbonates of the alkalies, the corresponding dimetal salts are obtained, which have also been analyzed.

Use of Salts for Dyeing and Padding

Obviously any application of the salts of the alizarinemonosulphonic acid ester for dyeing processes would depend on a suitable method of hydrolysis. Such a method seemed to be available, because it was observed that the pyridine salt of the ester decomposed at about 100° C. In fact, it was found impossible to recrystallize this salt from boiling water without regenerating a considerable amount of alizarine. While this interesting property showed the pyridine salt to be probably too sensitive for dyeing operations, the alkali salts showed no tendency to decompose at temperatures requisite for dyeing or padding. Oxalic acid proved to be capable of hydrolyzing the alkali salts of the ester under conditions which would not damage the cotton fiber. Apparently the first reaction is the formation of the free ester acid which, being very unstable in the presence of water, decomposes at once into alizarine and sulphuric acid at higher temperatures.

In applying these observations the first difficulty encountered in using the pyridine salt was its poor solubility in water. This could be offset by the use of an excess of pyridine; but even then, as was to be expected, the alizarine preparation decomposed in the boiling dye bath before it was fixed on the material, so that the color utilization was very poor.

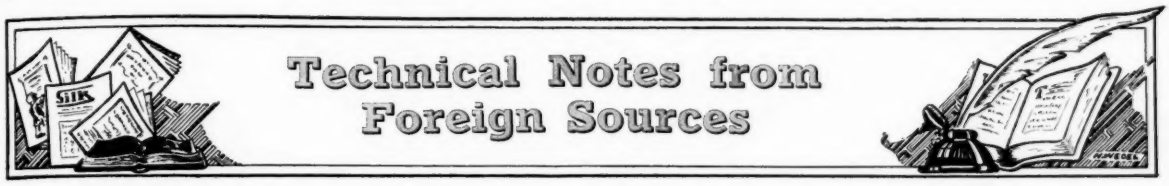
On the other hand, a padding process using material prepared in the usual way with calcium and aluminum salts was successful. The first experiments (A) with pyridine salt, without the addition of oxalic acid on material padded with calcium and aluminum salt, were not successful because the calcium and aluminum salts of the ester were formed in the ager before the ester had hydrolyzed. These salts, once produced, would not decompose at the temperature of aging without the action of an acid. Being a dull red, they impaired the brilliance of the shade obtained. Though they could be removed by a thorough washing of the material after padding, this method was obviously not economical, since a certain percentage of the alizarine was lost as the calcium and aluminum salts of the ester removed.

This difficulty was obviated by using a process (B) based on hydrolysis with oxalic acid which decomposes all the salts of the ester at higher temperatures, thus allowing the use of the very readily soluble alkali salts of the ester. This process gives a brilliant red equal to the shades obtained by the old methods of dyeing Turkey Red with alizarine, yet the whole procedure does not take more than fifteen minutes.

Procedures for Padding Process—(A) The material, previously treated in the usual manner with aluminum and calcium salts, was padded with 1 to 4% solution of the pyridine salt, which contained 2.5% pyridine for each per cent of dyestuff. The material was dried and a yellow-orange color obtained. The alizarine red was developed by heating the material in a Mather Platt apparatus for ten to fifteen minutes at 2 atmospheres pressure. In order to obtain a brilliant and clear red, the material had to be washed very carefully with hot soapy water to remove the non-hydrolyzed and insufficiently fixed calcium and aluminum salts of the alizarine ester.

(B) The material, impregnated with calcium and aluminum salts in the usual way, was padded with a cold solution containing 3 to 5% sodium or potassium salt of the alizarinemonosulphonic acid ester and an equal amount of oxalic acid. After drying, the material was treated in the Mather Platt at 110° C. for ten to fifteen minutes with fairly dry steam. Brilliant and clear shades of alizarine red were obtained.

—*Industrial and Engineering Chemistry.*



Affinity of Indigosols for Cotton

D. S. Naylor, J. Soc. Dyers Col., 20, 33 (1928).—The author points out, in correction of a statement recently made by Peterhauser (J. Soc. Dyers Col., 253, 43, 1927), (previously noted in these columns), that all Indigosols have some affinity at least for vegetable fibers (printed as "dyes" by oversight); that in some this natural affinity is very slight, but that in other cases it is so great as to be comparable with that of the direct cotton colors. He further states that, contrary to a statement by Harris (J. Soc. Dyers Col. 362, 43, 1927), in each of the series of indigo, thio-indigo and quinone-anilide vat dyestuffs, there are Indigosols which have a marked affinity for vegetable fibers, and this particularly in the case of dyestuffs of high molecular weight, e. g., the naphthindigos. The interest of the dyestuff manufacturers lay at first in those Indigosols which were suitable for printing, but Indigosols having direct and good affinity for cotton have been known from the first; and doubtless they will be placed on the market as soon as a fair range of colors is ready.

Aromatic Tetrahydronaphthylamines

O. Y. Imray and Soc. Chem. Ind., Basle, English Patent No. 276,571.—N-derivatives of alpha- or beta-naphthylamines, as N-acetyl-, N-ethyl-, or N-phenyl-derivatives, can be prepared by catalytic reduction with hydrogen, as is usual with naphthalene itself. The free tetrahydronaphthylamines (ar-tetrahydro-) are obtained from the acetyl-derivatives by ordinary hydrolysis, e. g., heating with 70% sulphuric acid.

Vat Dyestuffs—Intermediates

Newport Chemical Co., English Patent No. 260,544.—2- or 3-chlorquinizarine is obtained by condensing 3-4-dichlorphenol with phthalic anhydride, using sulphuric acid, concentrated or fuming, and boric acid, as condensing agents. The product is pure, and the yield 80%. As usual, the reaction can be stopped at the intermediate stage, and the 2-hydroxy-4-5-dichlorbenzoyl-o-benzoic acid formed may be isolated.

Vat Dyestuffs—Intermediates

I. G. Farbenindustrie A. G., (M. L. B.), English Patent No. 261,422.—Anthraquinone nitriles are obtained in good yield by heating a halogenated anthraquinone with cuprous cyanide in presence of an aliphatic or aliphatic-aromatic nitrile, with or without pressure. The products, when hydrolyzed, give the corresponding carboxylic acids.

Vat Dyestuffs—Intermediates

A. Lechler and H. E. Fierz, Helv. Chim. Acta., 642-670, 10 (1927).—An important article dealing with a large number of derivatives, of various sorts, of 1-nitro-2-methyl-anthraquinone, which should be of interest to those carrying on research work in the synthesis of dyestuffs of this group.

Vat Dyestuffs—Intermediates

R. E. Schmidt and R. Berliner, and I. G. Farbenindustrie A. G., English Patent No. 277,109.—A modification of English Patent No. 244,462. Alpha-aminoanthraquinone or its derivatives is condensed with formaldehyde, in the presence of sulphuric acid of 70 to 90% and a metallic reducing agent, as copper or aluminium.

Also English Patent No. 277,110; same authors. A modification of English Patent No. 244,463. The condensation products of English Patent No. 244,462 are oxidized by nitric or nitrous acids in aqueous suspension.

Vat Dyestuffs

I. G. Farbenindustrie A. G. (M. L. B.), English Patent No. 254,294.—A water-soluble dyestuff, probably better classed at present as an acid dyestuff, prepared by boiling bz-1-nitro-benzanthrone with sodium bisulphite solution. The product dyes wool, silk or cellulose acetate bright red from an acid bath.

Vat Dyestuffs

British Dyestuffs Corp., Ltd. (J. Baddsley, A. Shepherdson and S. Thornley), English Patent No. 276,766.—By direct sulphonation of benzanthrone, with or without catalysts such as mercury, sulphonic acids are obtained which, on fusion with KOH, yield hydroxy-di-benzanthrones. These dye cotton reddish-blue from the alkaline hydrosulphite bath.

Also English Patent No. 276,768; same authors as above. These hydroxy-dibenzanthrones may be alkylated in various ways, preceded by oxidation, if desired, or by oxidation followed by reduction. The products thus obtained give deeper shades and are more fast to acid and alkali.

Azo Dyestuffs

I. G. Farbenindustrie A. G. (M. L. B.), English Patent No. 256,272.—4-nitro-2-amino-1-benzoic methyl ester, or a similar compound, is diazotized and coupled with any "naphthol" of the Naphthol AS series, except the bis-(beta-hydroxynaphthoyl)-4-4'-diamine-3-3'-diaryls. Products are bluish-red pigments, suitable for wall paper, etc.

Pyrazolone Azo Dyestuffs

I. G. Farbenindustrie A. G. (M. L. B.), English Patent No. 261,770.—Greenish-yellow dyestuffs, suitable for

ordinary use or as lakes. Some can be improved, when dyed, by afterchroming.

Pyrazolone Azo Dyestuffs for Acetate Silk

Soc. Chem. Ind. Basle, English Patent No. 256,205.—Diazotized aniline is coupled with 1-(2'-chlor)-phenyl-3-methyl-5-pyrazolone in dilute sodium carbonate solution. The product is not dried, but ground moist with a suitable protective colloid, such as sulphite cellulose liquor. It dyes cellulose acetate fast yellow from an aqueous suspension.

Dispersion of Azo Dyestuffs or Pigments

J. Y. Johnson and I. G. Farbenindustrie A. G., English Patent No. 276,767.—A method of preparing an azo dyestuff in a very finely divided state by addition of an aromatic sulphonic acid containing a hydrocarbon side-chain, to one of the components, before coupling. A propylated or butylated naphthalone-sulphonic acid is particularly specified.

Vat Dyestuffs

I. G. Farbenindustrie A. G., English Patent No. 263,845.—A modification of English Patent No. 248,791. bz-Aroyl-hydroxybenzanthrones are treated with anhydrous aluminium chloride at 220 to 240° C., by which they are converted to hydroxy derivatives of dibenzpyrenequinone. Certain of these products dye deep reddish-brown from alkaline hydrosulphite baths. Etherification of the hydroxyl group gives products which from the hydrosulphite bath dye yellow to orange-yellow.

Vat Dyestuffs

British Dyestuffs Corp., Ltd., and S. Thornley, English Patent No. 276,767. A modification of English Patent No. 276,766 (q. v.), consisting in dissolving the hydroxybenzanthrones in concentrated sulphuric acid and treating with hydroxylamine or its salts, with or without addition of ferrous sulphate. The products give bluish-grays to blacks on cotton from the hydrosulphite vat.

Increasing of Resistance of Acetate Silk to Boiling Aqueous Baths

Silver Springs Bleaching & Dyeing Co., Ltd., and A. J. Hall, English Patent No. 277,089.—The finished acetate-silk fiber is stretched beyond the elastic limit in the presence of an assistant, such as alcohol, acetone, formaldehyde or glycerol, which may be in a suitable solvent or in the vapor form. For example, the yarn is soaked in 20% aqueous alcohol for half an hour at 20° C., stretched 25%, washed and dried. Fiber so treated resists the action of boiling water for at least half an hour.

Aniline Black Dyeings

Calico Printers' Association, Ltd., L. A. Lantz and R. Watson, English Patent No. 279,164.—The goods are prepared with aniline salt, chlorate and ferrocyanide, dried, and passed through a preheater, with dry heat of 110 to 180°, for from five to forty-five seconds, then treated in the ager with steam, at the same temperature, for from fifteen seconds to one minute. The preheater and ager may be combined in the same apparatus. The goods are then washed in water or weak alkali. It is claimed that the blacks thus obtained are proof against greening without aftertreatment, and that the material is not tendered.

Azo Dyestuffs for Artificial Silk

I. G. Farbenindustrie A. G., English Patent No. 266,940—Omega-hydroxy-alkyl-phenyl ethers, formed by condensing salts of phenols with halohydrines such as ethylene chlorhydrine, are converted to acid sulphuric esters by treatment with a sulphonating agent such as sulphuric acid or chlorsulphonic acid. These esters may be used as intermediates in the preparation of azo-dyestuffs suitable for dyeing artificial silk. The hydroxy-alkyl ethers of phenols, naphthols or hydroxy-anthracenes, and derivatives thereof, are specified. As example, the acid sulphuric ester from n-amino-p-cresol-omega-hydroxy-ethyl ether, when diazotized and coupled with beta-naphthol, produces a bluish-red dyestuff, or when coupled with diazotized p-nitraniline gives a yellowish-red dyestuff, suitable for dyeing acetate silk.

Dyes for Artificial Silk

United States Patent No. 1,653,757—Secondary disazo dyestuffs, prepared from amino-ortho-hydroxy-carboxylic acids of the benzene series, by diazotization and coupling to the usual second components, are further diazotized and combined with 1-naphthol-4- or 5-sulphonic acid, or other component of the naphthalene series containing a single auxochrome group. Several examples are given. The dyestuffs are suitable for regenerated cellulose.

Photographic Application of Indigosols

W. Cowpe, Dyer and Cal. Printer, 117, 58 (1927)—Certain of the soluble vat dyestuffs, as Indigosol Orange HR, Scarlet HR and Pink HR, are decidedly sensitive to ultraviolet light. If cloth is padded with an aqueous solution of any of these dyes, dried and printed under a photographic negative to the proper point, the unoxidized portion may be washed out with a boiling soap solution, leaving the fabric printed with the dyestuff. In the wet state the dyestuffs mentioned are almost as sensitive to sunlight as some photographic papers. Indigosols O4B and HB are not so sensitive.

Stabilized Diazo Salts

I. G. Farbenindustrie A. G., English Patent No. 273,352—The diazotized bases are stabilized by mixing with them metallic salts of aryl-sulphonic acids, particularly those of benzene-sulphonic and -disulphonic acids, benzyl- and tetrahydronaphthalene-sulphonic acids, the 1-6, 1-7 and 2-7 disulphonic and the (1-3-6-?) trisulphonic acids of naphthalene.

RECENT LITERATURE

A Symposium on Starch

A Comprehensive Survey of Starch Chemistry—Vol. I. Compiled and edited by Robert P. Walton in collaboration with twenty other authors. 604 pages. Chemical Catalog Co., Inc. $10.00.

This is by far the most complete treatise upon starch chemistry that has been published in English, comprising as it does a complete detailed bibliography of 330 pages describing 3,485 references, and in addition 240 pages of a symposium upon the following subjects, each written by an authority who has contributed significantly to the advancement of this field and who is still actively engaged in further investigations of his particular branch. Each chapter therefore constitutes an individual monograph:

1. Thermal Depolymerization of Starch in Relation to Molecular Constitution—Ame Pictet.

2. Methylation of Starch in Relation to Molecular Constitution—Sir James C. Irvine.

3. Enzymic Hydrolysis of Starches in Relation to Constitution—Arthur R. Ling.

4. Bacterial Degradation and Constitution of Starch—Hans Pringsheim.

5. The Colloid-Chemical Properties of Starch—Max Samec.

6. Non-Carbohydrate Constituents as a Factor in the Characterization of Starch Components — T. Clinton Taylor.

7. The X-Ray Spectography of Starch—Johann R. Katz.

8. Chemical Nature of Certain Amylases—Henry C. Sherman.

9. The Role of Starch in Bread-Making—Carl L. Alsberg.

10. Gelatinization and Retrogradation of Starch in the Bread Staling Process—Johann R. Katz.

11. Conversion of Starch in the Fermentation Industries—Auguste Fernbach.

12. Manufacture of Corn Starch—George M. Moffett.

13. Manufacture of Potato Starch—Eugen Preuss.

14. Manufacture of Dextrin, Envelope Gums, British Gum and Modified Starches—Victor G. Bloede.

15. Starch and Flour Adhesives—Jerome Alexander.

16. Significance of Starch Viscosity in the Manufacture of Paper and Textiles—Walter A. Nivling.

17. The Use of Starch in the Textile Industry, Particularly for the Sizing of Cotton Warps—Frederick Denny Farrow.

18. Starch-Converting Enzymes Used in the Textile Industry—H. G. Gore, H. G. Turley, Leo Wallerstein and Jokichi Takamine, Jr.

19 Early Development of Starch Chemistry and Manufacture—Robert P. Walton.

The author states in his preface that this field, like many others, is not without its contradictory observations and theories. The molecular complexity and colloidal state of starch substances, as well as the inability to definitely characterize their transforming enzymes, have introduced many experimental handicaps. A difference in technique introduces a difference in the recorded observation; more often, a difference in perspective introduces a difference in the resultant theory. The experimental observations referred to in this symposium rarely stand in direct contradiction, the premises based on these observations almost invariably containing a conflicting element. The conflicting theories included here, necessarily, are somewhat confusing to a student of the subject. Although such a tournament of concepts does not immediately contribute toward a clarification of the situation, the pre-eminence of its entrants makes this the only basis from which an acceptable formulation can be constructed. No deduction as to starch constitution or conversion merits consideration which has not included or satisfactorily refuted the concepts presented here.

This volume may well serve as an encyclopedic reference volume for large users of starch in the textile and paper industries. The physical and chemical characteristics of starches and dextrins are treated, of course, throughout the whole book.

Specifically, pages 228 to 242 of Part II list and abstract most of the material on starch sizing which has been published in the various periodicals. The last three articles in Part I (pages 188 to 234) deal directly with the principles and practice of starch and dextrin applications in the textile industries. While this latter material is not intensely practical to the point of presenting a group of empirical formulas for the procedures of finishing, sizing, etc., it constitutes a very thorough and fundamental treatment of the principles involved and obviously a clearer understanidng of such principles will be highly profitable to the starch user. Pages 130 to 187 (Part I) dealing with the manufacture of cornstarch, potato starch, modified starches, dextrins, British gums, etc., are of interest to the textile and paper user in a secondary way. A great deal of this information is not available elsewhere.

A corresponding survey of patent literature is planned to appear later as Volume II of this series. L. A. O.

The Societe Industrielle des Produits Chimiques de Bozel-Maletra has decided to increase its capital for the purpose of establishing a new company for the production of rayon by means of a new process. The new company will have a capital of 25,000,000 francs, entirely subscribed by the Bobel-Maletra company and by two important textile groups in the north of France, according to advice from Assistant Commercial Attache Daniel J. Reagan, Paris.

TWO VAT COLORS AMONG NEW DU PONT DYES

A reddish-violet dyestuff, described in the announcement as possessing excellent fastness and good working qualities, has been developed by the dyestuffs department of E. I. du Pont de Nemours & Co., and is now being marketed under the name of Sulfanthrene Violet R Paste.

This new dye is a vat color that can be dyed on all forms of cotton, either raw stock, yarn or pieces, and may be used in circulating machines. Its chief use, it is stated, will be for dress goods, shirtings, etc., that must stand wear and repeated washing. It is, however, recommended for use on both silk and rayon. Because of its easy working qualities and freedom from grit, the announcement further states, it is offered as a color which will find extensive use in the printing trades.

The second new vat color added to the Du Pont list is known as Sulfanthrene Pink FB Paste, a dye which yields clear, brilliant pinks. It is described as extremely fast to acids, alkalies, washing, perspiration, chlorine and peroxide bleach, and cross-dyeing. It is also claimed to show good resistance to boiling soap and soda ash.

A NEW BORDEAUX FOR COTTON ON NATIONAL LIST

An improved type of Sulphur Bordeaux 2R Conc. is now being produced by the National Aniline & Chemical Company, according to a recent announcement from that firm.

This new Bordeaux possesses a shade somewhat redder and brighter than National Sulfur Bordeaux R and similar types. It is described as readily soluble with one and a half times as much sodium sulphide conc. as of dyestuff, and may be used alone or in combination for producing a wide range of shades in all types of machines. It is said to be particularly valuable in producing cutch, mahogany and other red-brown tones on cotton in all stages of manufacture.

ROUTH APPOINTED SALES MANAGER OF MATHIESON

Following the resignation of John W. Poyer as manager of sales of the Mathieson Alkali Works, Inc., that firm has appointed E. E. Routh to the position. Mr. Routh has been connected with the Mathieson organization for thirty years, with the exception of four years in college. He started as office boy at the Saltville, Va., plant at the age of eleven; for the past eight years he has held the post of Southern sales manager, with headquarters at Charlotte, N. C. In his new capacity he will be located at the executive offices of the company in New York

Fred O. Tilson has been appointed to succeed Mr. Routh as Southern sales manager. He has been representing the company in the Southwest.

WILLIAM H. NICHOLS, JR.

William Henry Nichols, Jr., son of the chairman of the Allied Chemical & Dye Corporation, and himself a prominent figure in the American chemical industry, died of pneumonia May 26 at his home at Center Island, Long Island. He was fifty-four years old.

Mr. Nichols was president of the General Chemical Company, director of numerous chemical manufacturing concerns, and actively interested in the scientific as well as the industrial advancement of American chemistry. He was a vice-president and director in the Allied Chemical & Dye Corporation and a director of the Corn Products Refining Company, the National Aniline & Chemical Company, the Nichols Chemical Company, Ltd., the Semet-Solvay Company and the Solvay Process Company. He also held directorships in the John P. Tilden Company, Inc., and the Barrett Company, and he was a trustee of the Central Union Trust Company of New York.

Effective June 1, 1928, Philipp Moll, formerly sales manager of C. H. Boehringer Sohn, Hamburg and Nieder-Ingelheim on Rhine, and more recently vice-president and sales manager of the Dissosway Chemical Company, became associated with the Roessler & Hasslacher Chemical Company as assistant to manager of sales.

Z. H. Mangum, superintendent of the Avondale Mills, Birmingham, Ala., attended the commercement exercises at North Carolina State College, Raleigh, N. C., on June 4 and 5. His son, Z. B. Mangum, graduated from the Textile School with high honors and was awarded the Student's Medal given annually by the National Association of Cotton Manufacturers to the most proficient student in the textile manufacturing ocurse.

Z. B. Mangum delivered the valedictory address to the class of 1928 and his excellent record was highly complimented by L. R. Gilbert, president of the Southern Textile Association, who presented the National Association medal.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i. e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

EXPERIENCED DYER

Unusually skilled dyer, twenty years varied experience on silk, cotton, rayon and Celanese (all forms and combinations, including hosiery) is available for position of head dyer where *production* is essential. Address: Classified Box 452, care of American Dyestuff Reporter.

SALES MANAGER

Sales manager wanted for Southern territory by well-known manufacturers and importers of dyestuffs, finishing materials, etc. Excellent opportunity for experienced man familiar with trade in the Carolinas, etc. Apply in strict confidence to Classified Box 463, American Dyestuff Repotrer.